AMERICAN MACHINIST

October 4, 1939

New Tooling—*Auto makers swing into production on 1940 models with large equipment programs. Here is the first operation on a Dodge truck banjo housing (page 809)*

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McGraw-Hill Publishing Company, Inc.

Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 68 Post Street; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

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VOLUME 83 — NUMBER 20

AMERICAN MACHINIST. Copyright 1939 by McGraw-Hill Publishing Co., Inc. Published every other Wednesday, price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3.00 a year. All other countries (except Europe and British possessions in Eastern Hemisphere), $6.00 a year or 24 shillings. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

A McGRAW-HILL PUBLICATION

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Your Introduction to the Metal Show

THE NEXT ISSUE OF AMERICAN MACHINIST

The NATIONAL METAL SHOW

Your introduction to the National Metal Show to be held in Chicago, October 23-27, will come with the next issue of American Machinist, published October 18. This issue will carry a complete list of exhibitors and what they are exhibiting; it will also contain an extensive section on new equipment that is being shown for the first time at Chicago.

A feature will be the sixth in American Machinist's current series on materials. This section, "The Working of S.A.E. Nickel Steels," will follow a pattern similar to preceding special sections on the working of materials. Heat-treating, machining, finishing, and other characteristics of S.A.E. Steels are to be discussed and valuable reference data included.

Watch for the next issue; study it before leaving for Chicago, and save it for future reference.

P. S. Additional copies of preceding special sections on materials are available. These articles are:

The Working of Stainless Steels
The Working of Wrought Coppers and Bronzes
The Cutting Carbides
The Working of Plastics

Address your request for reprints to Editor, American Machinist, 330 West 42nd Street, New York City. Kindly enclose 15 cents in stamps for each reprint requested to cover handling and reprint costs.

BUSINESS
Stands Against War

Let us take a clear-eyed look at this thing we call War.

WAR is a political tool for domination or suppression; a device of futility—unless it be waged in defense of our homes, our property or our rights—in the preservation of our liberty. War destroys everything it touches. So completely does it disrupt the order and progress of civilization that humanity falters.

Dangerously widespread amongst our people today is the assumption that our participation in the European War is inevitable. Some mistrust the temper and program of the federal government as likely to lead us into it; others fear that our sympathies will make us an easy prey to the propagandists; still others suspect that business and industry, in a blind greed for profits, may involve us in the conflict.

To give credence to such beliefs is to deny that we are normal individuals, endowed with intelligence and a will, or the ability, as a people, to profit by our own experience. In all human experience, death only is inevitable.

To say that Industry and Business want war or will encourage, directly or indirectly, our participation in the present war, is a vicious and deliberate lie.

The millions of us who, since the World War twenty-five years ago, have devoted all our efforts and energies to creating and building and improving that which we know today as American Industry and Business, are convinced that the destiny of this country can be wrought only in peace. We cannot, and *must* not, stand aside and watch even the little progress we have made since that war sacrificed to the pestilence of another world conflict. We who are trying to build a lasting heritage for those who will follow us truly know that "there never was a good war or a bad peace".

Perhaps it is time to re-emphasize two of the three elements of our democratic faith, so simply stated by Abraham Lincoln, "that government of the people, by the people, for the people, shall not perish from the earth". Now, of all times, it will be wise to inform our political stewards that government by the people and for the people must be the guiding principle in what they do during the days to come, and that it is our *will* that in our country peace shall be preserved.

Only the grim and solitary courage of each of us, the determination to exert all our intelligence, all our individual influence in every way, can insure the preservation of peace for our country.

Preparedness we know to be the most effective preventive weapon against the threat of war. We must be certain, therefore, that we provide our air, land and sea forces with the best in armaments and material, in adequate supply to maintain properly and impressively our national responsibilities and defense.

Most important is that we as individuals, thus inspired, band together to exert the full strength of Industry and Business in the maintenance of peace.

If we are to succeed, we must be forceful, we must be articulate. To that purpose we pledge ourselves and the resources of our publications. An expression from our readers will greatly assist in such a mobilization of industrial opinion. Together, in this critical time, we can serve America well!

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

How Educational Orders Are Placed

By BRIGADIER-GENERAL C. T. HARRIS, JR.
Assistant to Chief of Ordnance
War Department, Washington

PREPARATION of American industry to fulfill its vital rôle in the event of war is the sole aim of the educational orders program.

The policy in carrying out the program is one of complete cooperation with industry, since the primary purpose is to familiarize selected manufacturers in peace-time with some of the more difficult problems of munitions manufacture so that they may assist the government in procurement of this complicated material in time of war.

The War Department has had as its general objective the selection of manufacturing concerns believed to be qualified to make the critical items and the placing of orders with these companies for work mainly of an engineering nature.

One of the objectives is to obtain in peace-time those dies, jigs, fixtures and other aids to manufacture the lack of which would cause considerable delay to a munitions program in a war emergency. This equipment would become the property of the government upon completion of the educational order and would be stored until the necessity for its use should arise.

The Army designs, specifications, drawings, etc., where necessary, may be reviewed to determine whether they are completely adapted to quantity production methods. When all questions of design are settled, the company awarded an educational order will buy or manufacture such special machinery, dies, jigs and gages as are needed to produce the item. The company then will make only a sufficient quantity of the article to insure that the engineering work and the equipment provided are satisfactory.

As the order proceeds, complete records will be kept to serve as a basis for a production study showing the necessary reorganization of the plant for a war order. The job will be completed only when the War Department is furnished with what might be regarded as a factory plan covering most of the usual elements which would be included in a scheme to manufacture some new item in everyday commercial practice.

The production study is of great value. It epitomizes what the manufacturer has learned and incidentally educates the War Department as to what may be expected from the plant as a result of an actual minimum test.

Approximately 10,000 plants have been allocated for munitions purposes in this country during the past two decades. Many of the factories have spent much time and have gone to considerable expense to prepare production studies, including acceptable schedules of output, for critical items for which there is no ordinary peace-time demand. The educational order program provided the War Department with the means to educate further a few of the companies which have been allocated work

on strictly non-commercial items and which have contributed so freely of their time and money in preparing factory plans.

When an educational order for an item is contemplated, reliable firms from the allocated list are selected to be given an opportunity to bid. This means that the War Department has put its seal of approval, so to speak, on the ability of the companies chosen to perform the task assigned them. Since preparation of a bid on any job entails expense to the bidder, it has been the custom to recognize this fact and, all other factors being equal, to award the contract to the lowest bidder on the selected list. This procedure is not required by law, but is believed to be fair, since the capacity of a company to produce was determined before it was selected to bid.

Authority for educational orders is contained in the Act approved June 16, 1938 (Public Law No. 639), which is a measure to provide for placing educational orders to familiarize private manufacturing establishments with the production of munitions of war of special or technical design, non-commercial in character. The items selected for such orders must be of the highest priority, in an essential category, standard for procurement in war and must have the probability of remaining standard for a considerable period of time.

Close attention has been given to the requirement in the Act that the Secretary of War shall have regard solely to the selection of such bidders as will in his judgment, under all circumstances, best serve the interest of the United States and best promote the cause of national defense. The legislation also requires that no contract shall be entered into without the approval of the President.

After the passage of the Act for educational orders, a board of army officers was appointed to select the articles to make up the first orders, $2,000,000 being made available to begin the program. The following items were chosen by the board for the initial program:

U. S. caliber 30 M1 rifle (semi-automatic)
3-inch A.A. gun recoil mechanism
75 mm. shell forging
75 mm. shell machining
Gas mask
60-in. searchlight

Procurement of the gas masks is the responsibility of the Chemical Warfare Service, searchlights of the Corps of Engineers, the other items of the Ordnance Department.

The Goodyear Tire & Rubber Company obtained the contract for the gas mask; the Winchester Repeating Arms Company for the new semi-automatic rifle, recently standardized by the Army; the General Electric Company for the searchlight used by the anti-aircraft artillery; R. Hoe & Company for the intricate recoil mechanism of the anti-aircraft gun; the S. A. Woods Machine Company for machining the 75-mm. shell required in such vast quantities in battle; and the American Forge Company for the 75-mm. shell forging, the manufacturing operation preceding that of the machining of this type of shell.

During the last fiscal year the modest start made in the educational order program encouraged the Congress to approve a more ambitious program so that this fiscal year $14,250,000 has been made available of which $8,800,000 was apportioned to the Ordnance Department for educational orders pertaining to ordnance items. A program has been prepared and approved for this amount and is now in process of execution. It is believed, based on a limited experience, that dollar for dollar money spent on educational orders will pay largest dividends in preparedness.

FUTURE EDUCATIONAL ORDERS

FOLLOWING its initial authorization of $2,000,000 for educational orders, Congress included an additional $14,250,000 for this purpose in its 1940 program. It is anticipated that during the next session of Congress the plan will be greatly expanded.

A full list of critical items through which industry is to be tied in with the general mobilization plan totals 55. Circulars on all of them are nearing completion.

Orders Educate Both Government and Industry

IN CARRYING OUT the educational orders program, the War Department is pursuing a course heartily approved by a civilian committee of review from industry. The committee agrees with the military officers that there are three possible alternative methods bearing upon the scope of an educational order:

1. Should an educational order provide principally for the preparation of a production study and limited production of the item?

2. Should the order provide for complete mass production of a large quantity of the item, all the necessary machinery including jigs, dies and fixtures, plus a production study based thereon?

3. Should the order provide for a compromise between these two extremes: That is, the installation of a skeleton production line, the production of sufficient quantity to test it, and the preparation of a production schedule based upon the experience thus gained.

The committee points out that the procedure and objectives recommended by the War Department board anticipates the third of these methods. With this conclusion the committee is in agreement. Says the committee in a letter to Louis Johnson, Assistant Secretary of War.

"This method will provide for the acquisition of some special machinery in time of peace, which machinery is essential in time of war. It is especially important for wartime effectiveness not only that designs of such special machinery be made in time of peace but that the contractors have also some actual experience in the use of at least one of each special type of machine in order that a working test in actual operation may be had. Thus the time factor in wartime production will be greatly aided."

The committee's conclusions are striking:

"Educational orders, being a relatively new phase of our national defense, are at this preliminary stage as much an education for government in procedure and objectives as they are intended to be an education for industry in production practices. Therefore changes in method are to be anticipated. Educational orders have a dual nature: they are contracts partly for service and partly for material. They must never be judged in the light of quantities of material actually produced. They can be evaluated solely on the basis of knowledge gained and necessary manufacturing equipment acquired."

Chrysler Girds for '40

Automobile maker spends millions for new equipment to increase manufacturing efficiency, to improve the quality of its cars and to reduce fatigue of its workers

By RUPERT LE GRAND
Detroit Editor, American Machinist

"We have invested upwards of $12,000,000 in new tools, dies, jigs and fixtures to produce the 1940 lines of Plymouth, Dodge, De Soto and Chrysler passenger cars. This, of course, does not include engineering expense, nor does it include improved manufacturing equipment and the rearrangement of facilities in our plants incident to 1940 production."

K. T. KELLER
President Chrysler Corporation

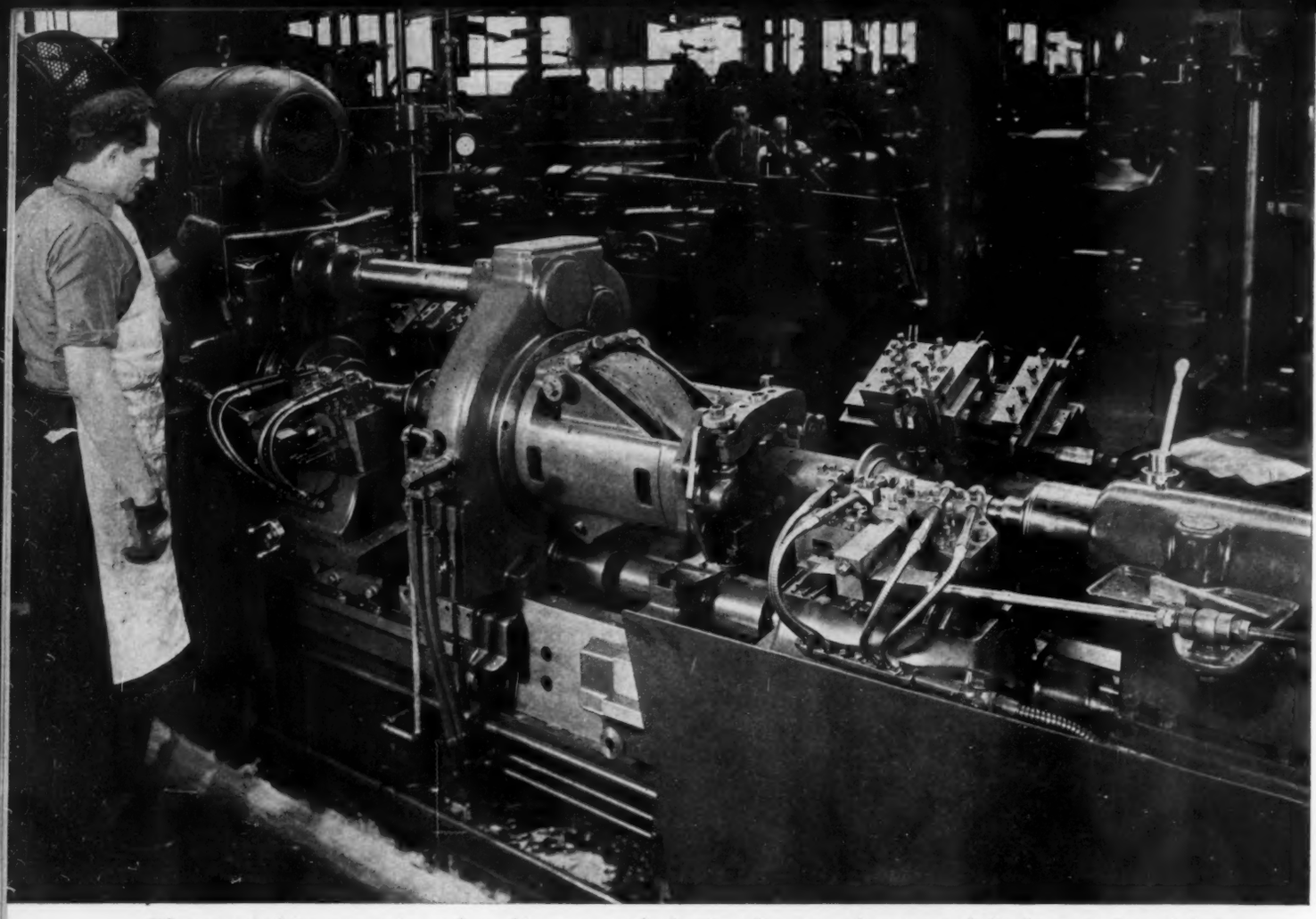
WITH THE 1940 model year at hand, the automotive industry again has dipped generously into its treasury to tool up for the next twelve months' production. In the front rank is the Chrysler Corporation. Its able manufacturing officials have looked over their production set-ups and made desirable changes here and there. In some cases, as at the Highland Park, Mich., plant, completely new machining lines have been installed. In other cases, close attention has been given to improved assembly methods, to new processes of body welding (Kercheval plant), to better technique of fender polishing (Plymouth) and to new ways for machining transmission parts (as at Dodge).

On the following ten pages *American Machinist* describes the extensive changes recently completed at Chrysler plants. Many beneficial results stem from these changes. To mention only a few—improved efficiency, a better product, enlarged output. These are some of the reasons why Chrysler thinks its $12,000,000 for new tooling has been well spent.

HIGHLAND PARK PLANT

A new design of differential gear and replacement of worn equipment are responsible for the Chrysler Highland Park plant being the chief beneficiary in the 1940 tooling-up program, at least in respect to machine tools. The shop has devoted itself to cutting service gears and making differentials. This year it added the machining of the truck axle housing, involving the purchase of nine new machines. The rear axle drive gear and pinion are now hypoids instead of spiral bevels, and new precision gear-cutting machinery had to be bought. Gear speeders, lapping machines, testing machines and cutter-grinding equipment were added to the list. Machine tools for making the differential case were replaced.

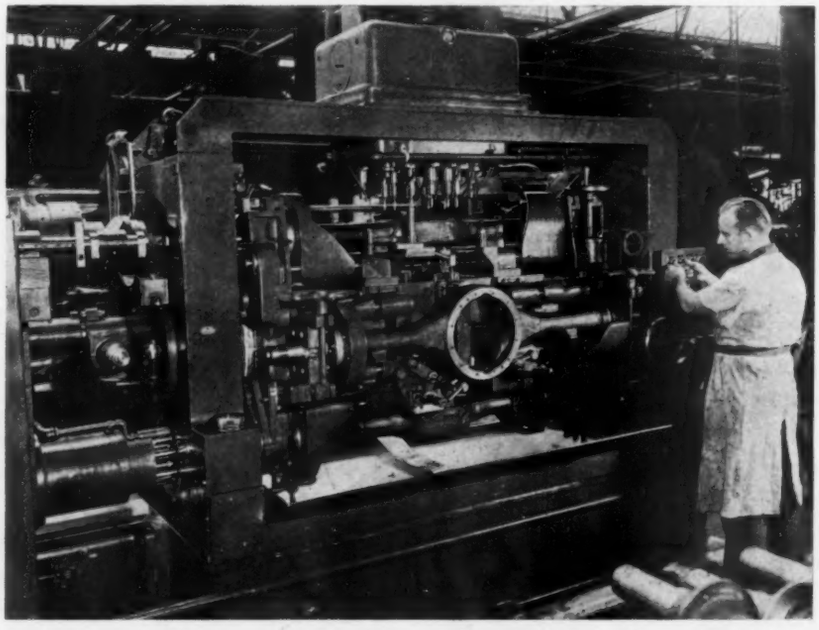
Completely new machining lines were worked out for the axle housing and differential parts. New units were put in these lines for reasons of increased accuracy, greater output, finer finish, or to take advantage of new methods. Approximately 50 per cent of the floor space formerly given over to these components has been saved in the modernized layout.



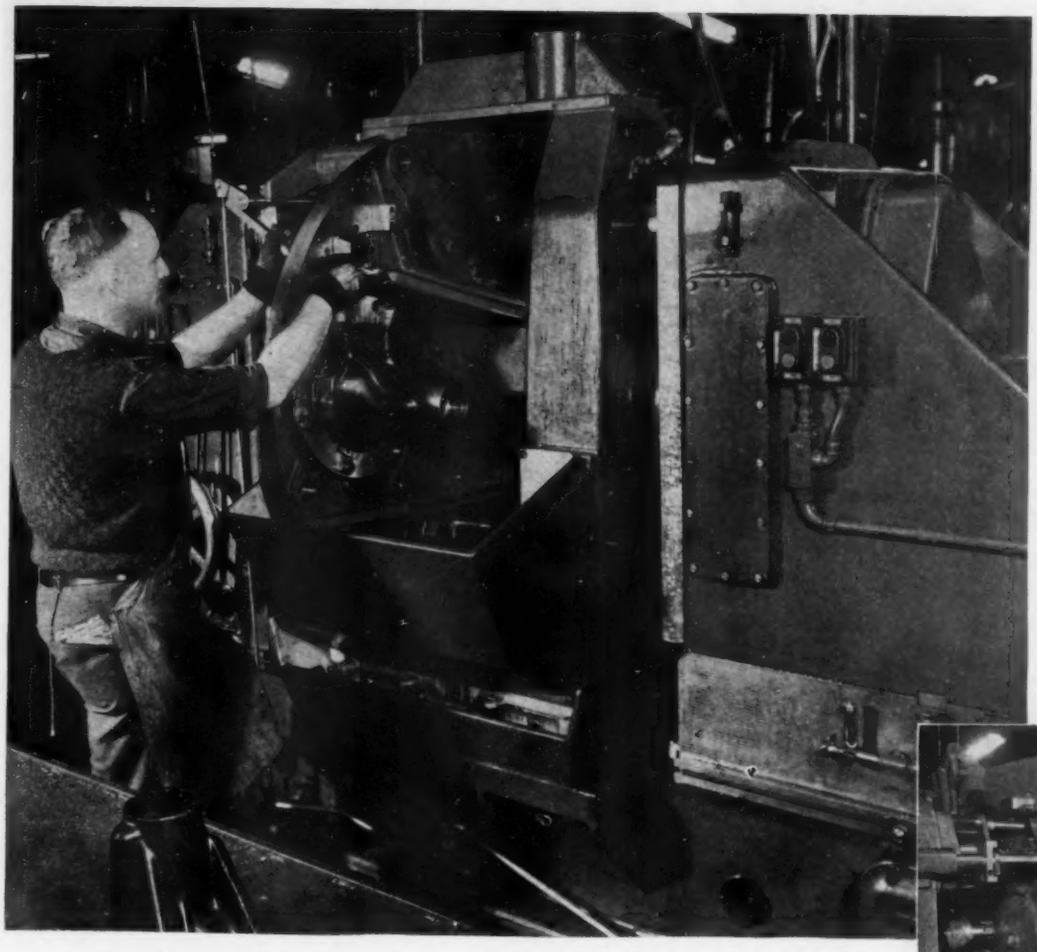
Three center-drive automatics such as this one turn the bearing diameters, the taper and the flange O. D. and face on housings of various lengths. Each end of the machine has front and rear slides, seven tools on each rear slide and five tools on each front one. High-speed steel tools are used

TRUCK AXLE HOUSING

Truck axle housings for Dodge 1½- and 2-ton trucks are now being machined at the Chrysler Highland Park plant. Multiple-head and drum-type machine tools combine operations, assure accuracy between important dimensions, and make for a short machining line. Besides handling six standard housings in lots, the line is flexible so that various specials with respect to vehicle tread can be accommodated by minor adjustments.



After grinding two bearing diameters and the taper on a centerless machine with three-step wheel, the axle housing is placed in this drum-type automatic, which has a multi-station head on the left end, a drilling head at the back and a tapping head at the top The four-sided indexing drum has a front loading position and three working stations—bottom, rear and top in that order. At the bottom position, the side head drills all holes in the face of the flange. At the rear position, the side head mills a keyway in the end, the rear head drills fourteen holes in one face of the banjo. At the top position, the side head advances a diehead to thread one end of the housing, and the top head taps the holes in the banjo. When the banjo comes around to the front loading position, it is reversed in the fixture, so that the same operations can be done on the other end and the other banjo face



DIFFERENTIAL CARRIER MACHINING

Second machine in the differential carrier line is this four-station machine that rough bores the cross bores, finish bores and chamfers the cross bores, and taps the cross bores, and on the additional head drills and taps the back-up screw for the ring gear

Two machines are used to machine the truck differential carrier. The first unit is this special double-end boring machine. This is a tough boring job because there is no pilot bar and the two drive pinion bores must be in line by 0.0005 in. These bores are rough, semi-finish and finish bored with single-point tools at the three operating stations. Three sizes of carriers can be accommodated by the machine by changing adapter plates. A head on top of the fixture drills and taps a lock pin hole for the pinion bearing lock

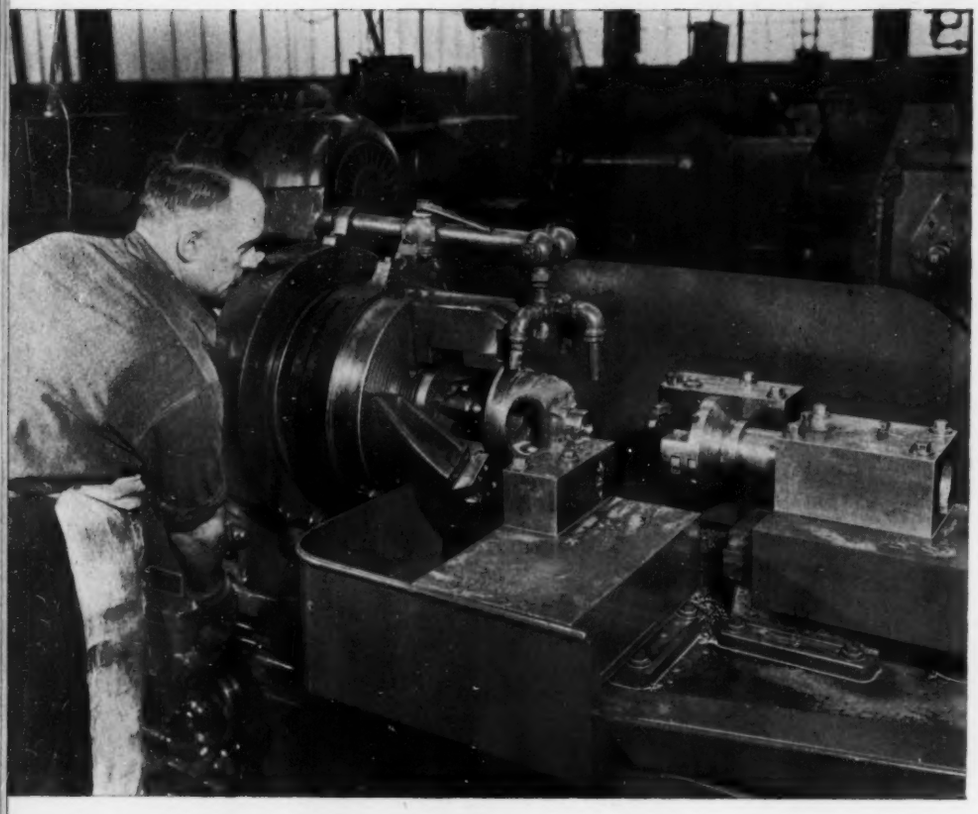
PINION TURNING

The need for grinding "green" rear-axle drive pinions is overcome at Chrysler Highland Park plant by installation of three high-production automatic lathes, which through their rigidity and ability to use tungsten-carbide tools properly can work constantly to the desired limits for stock removal. The rougher removes all but 0.040 in., the semi-finisher reduces that amount to 0.010 in., and the finishing machine works to ± 0.0005 in.

In the first operation, eight tools in front and back tool-posts turn four diameters and face the back and front of the pinion. A new special driver is actually an adjustable floating head, which will compensate for 0.004–0.005 in. runout of the forging. The tools operate at 301 ft. per min.

The semi-finishing machine runs at 470 r.p.m. (345 ft. per min.) and employs twelve tools. The finishing machine uses three tools cutting on the bearing surfaces at 352 ft. per min.

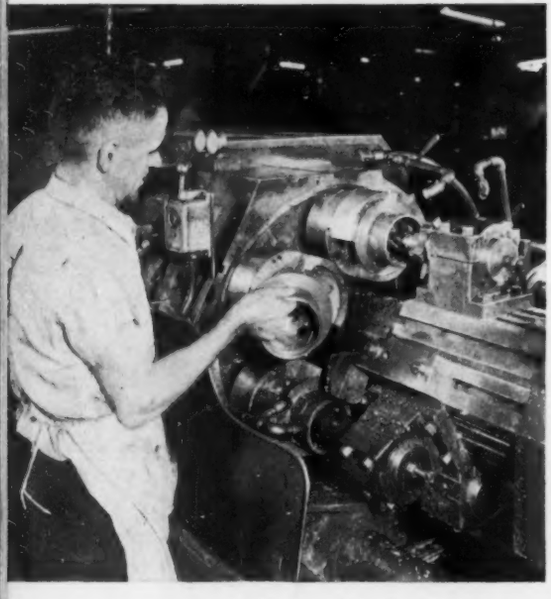
Accuracy of turning the rear-axle drive pinion with tungsten-carbide tools on automatic lathes is such that grinding of the "green" gear blank has been avoided



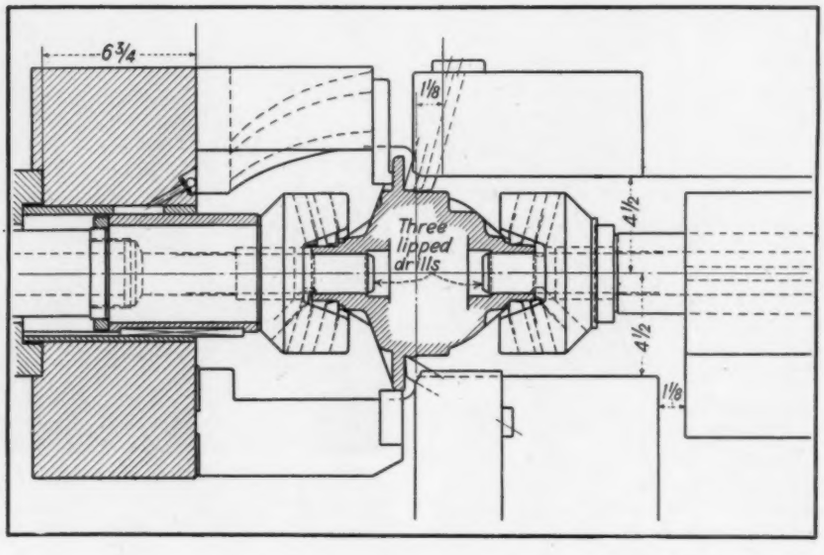
DIFFERENTIAL CASE MACHINING

A two-piece malleable-iron differential case is now being made at the Chrysler Highland Park plant for Dodge trucks. The two-piece design is more rigid, allows use of larger parts in a mechanism of the same over-all size, and facilitates assembly. Among new equipment purchased for this case is an eight-station automatic chucking machine.

A one-piece differential case for larger trucks is machined on a special lathe equipped with a cathead that operates within the spindle so that work can be done in back of the chuck jaws at the same time that tools are working in front of the jaws. The case is chucked on the flange. The cathead and the tailstock move in simultaneously to core drill the shaft holes, chamfer these holes, turn the O.D. of the hubs, face to length and chamfer on both ends simultaneously. Meanwhile front and rear slides operate on the piece. The front slide faces the flange and the back slide turns the ring gear fit and clearance

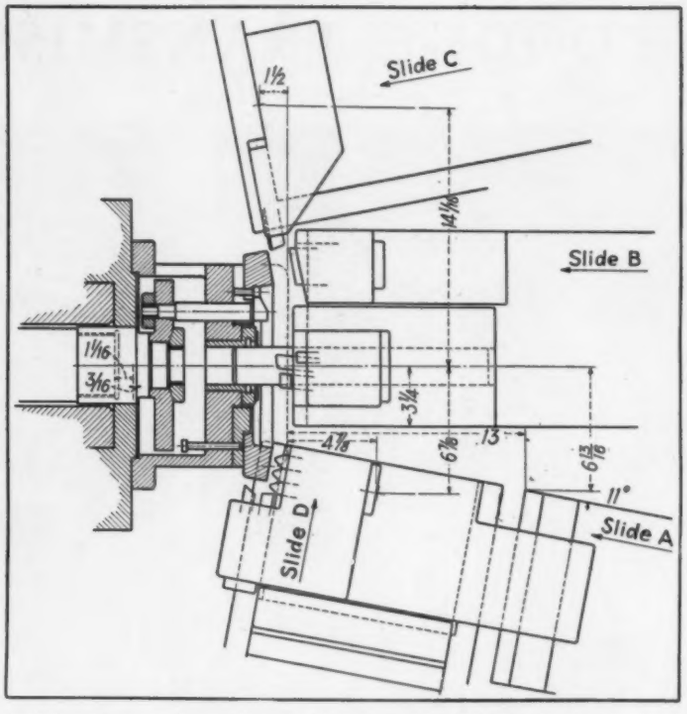


An automatic chucking machine performs these operations on the main casting of the two-piece differential case: (1) Face the flange and the end, (2) rough and finish turn the gear fit diameter, (3) turn the clearance on the gear fit diameter, (4) core drill and ream the axle shaft hole, and also counterbore and face the side gear seat, using a combination tool, (5) bore the thread diameter and ream a dowel fit for the cap, and chamfer, (6) tap, (7) finish ream the shaft hole and the counterbore, and finish face the side clearance and chamfer, using a combination tool



As the tool drawing shows, the automatic lathe applies tools to the one-piece differential case from four directions at the same time

Clamps passing through the center of the rough machined ring gear blank and hooking over the edge of the bore are automatically closed and opened by cam action, to save operator fatigue. The machine drills, reams and countersinks twelve holes, and indexes automatically



While the rough-machined ring gear blank is held in a special air-operated bonnet fixture, the scale on the front face is broken by three toolbits as slide A advances. Slide B causes a sweep tool to finish the front face and three other tools to turn the counterbore and taper. Slide C turns the O.D., Slide D chamfers the O.D.

RING GEAR MACHINING

Three new production lathes are installed for machining ring gear blanks. The first lathe performs the following operations: (1) rough the back face, (2) turn the inner face of the bolt-diameter flange, (3) rough and semi-finish the bore to 0.001 in. In the next set-up, an automatic-clamping, three-station indexing drill press drills, reams and countersinks twelve bolt holes.

Turning is resumed on a second lathe, which has a piloted chuck that holds the part from the bore and has a pin engaging one of the reamed bolt holes. In this set-up, the O.D., the front-face counterbore and a tapered hole are machined. The third lathe finish bores the part to 0.0005 in. and finish faces the back face so that a true clamping surface will be available when the piece is placed in the hypoid gear cutting machine.

An automatic production lathe fitted with four slides bearing tungsten-carbide tipped tools machines a number of surfaces on the ring gear blank simultaneously in the second lathe set-up. A sweep tool is an innovation in ring gear machining

DODGE TRANSMISSION DEPARTMENT

A specially designed double-end machine drills all holes in the milled ends of the transmission case, and bores and reams two large holes, one on each end, that locate the piece in later operations. The drum carries six fixtures. Indexing of the drum is done electrically and all machine movements are hydraulically operated to reduce operator fatigue to a minimum

REDESIGN of the transmission used in all Chrysler-built passenger cars made necessary the complete retooling of the Dodge transmission department. The transmission has been turned on its side to improve the shifting mechanism. A long transmission-case extension has been added at the rear so that the rear wheels could be moved back 7 in. to the "centers of percussion" to increase riding comfort.

The former transmission had a short, conventional mainshaft held in a ball bearing at the rear of the case and piloted at the front in a roller bearing within the end of the transmission drive shaft. The new transmission design has a mainshaft practically twice as long. The shaft is held at its center and rear by ball bearings in the transmission case extension, but the front end is supported in the pilot bearing as before.

In the former design, the single ball bearing permitted "float" to prevent binding at the pilot end, even with a little misalignment. The present support for the mainshaft is improved in that it is rigid and consequently the pilot end of the shaft must run perfectlv true, because the case and the extension are bolted together. This condition requires that the bolting surfaces of the two castings must be square with the bores. The *total* limit on the squareness of the end face of the extension with its bores is set at 0.002 in. at a 3½ in. radius.

In retooling the transmission case line and in setting up a new line for the transmission-case extension, it was necessary to establish operation sequences for each and to select machines so that improved accuracy could be maintained right from the start under production conditions. Operations are frequently combined to

After line reaming the two large holes, the transmission case is loaded on an arbor for finish turning the ends square. Down-cutting tungsten-carbide tools in the rear slides produce work so accurate that only an occasional piece need be checked for runout

maintain the desired relationship between vital dimensions.

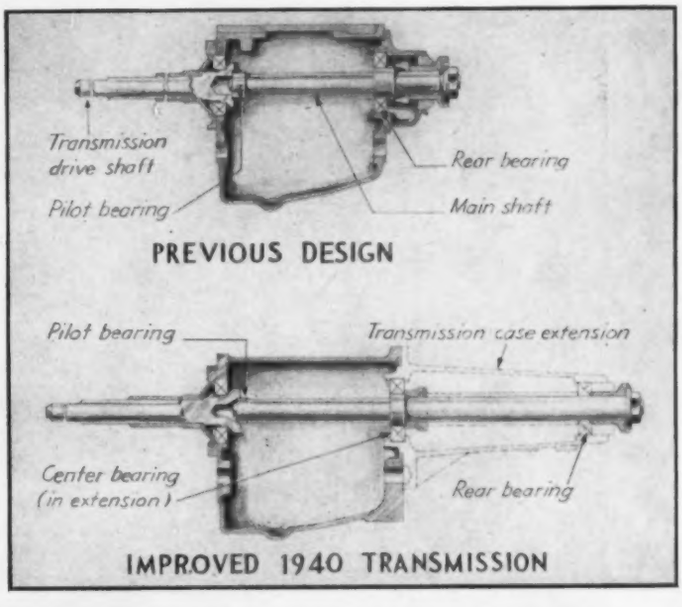
On the transmission case, the first operation consists of facing the ends in a drum-type milling machine equipped with fixtures that locate from the core to insure a uniform wall thickness throughout. Next, two dowel holes are drilled and reamed for locating purposes in the operations that follow.

One of the feature operations is performed on a double-end drum-type drilling and boring machine. This machine drills all the holes in both ends of the case and bores and reams two large holes, one on each end, that are used thereafter for locating purposes. After the case leaves this machine it passes through a number of operations, like line reaming, which are done for correcting purposes. Finally the case is put on a solid arbor, and both ends are turned with tungsten-carbide tools to insure squareness with the line-reamed holes.

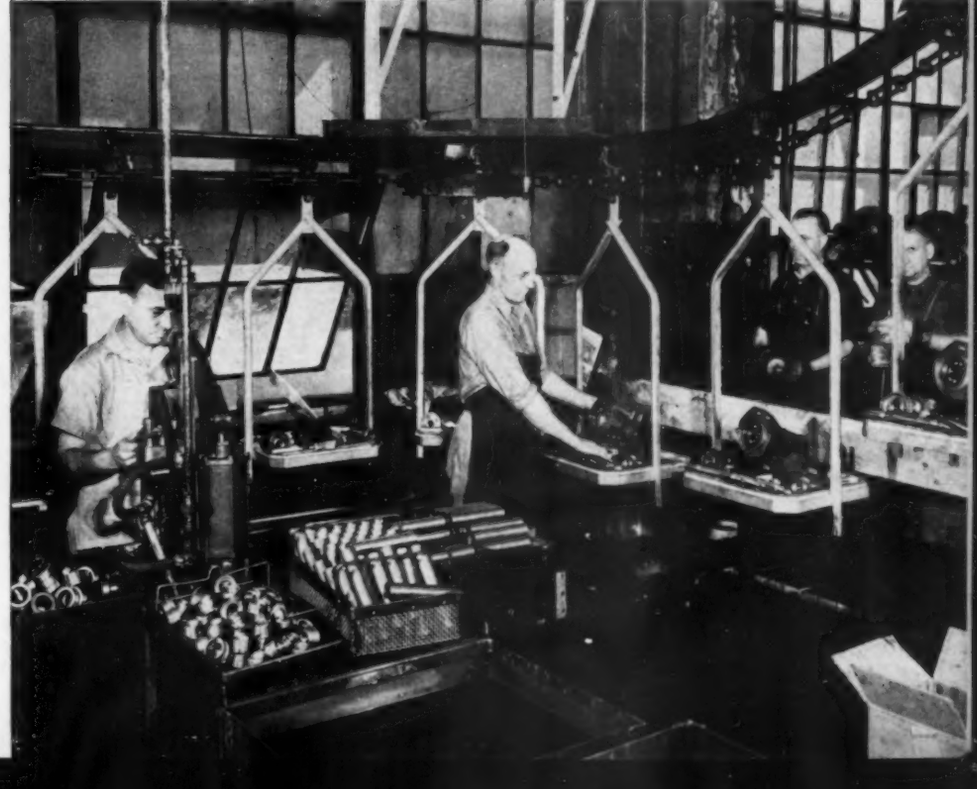
The first operation on the transmission-case extension consists of rough facing and turning a dowel for locating purposes in subsequent operations. The feature machines in this line are two large drum-type machines that bore, ream and drill all holes. Both units are double-end machines with hand-indexing station fixtures mounted therein. After the extension is bored and line-reamed, it is put on a solid arbor and the bolting surface is turned with tungsten-carbide tools in the same manner as for the transmission case. Succeeding operations are of minor importance compared with those already described.

Bearing seats in the big and small ends of the transmission-case extension are rough and finish bored, the big-end flange is faced and a snap-ring groove in the big-end bore is accurately undercut on a double-end machine. The heads have hydraulic feed and the drum is hand indexed

Schematic diagrams of the former transmission and the improved 1940 transmission show that the latter involves making the bolting surfaces of case and extension square with the line-reamed bores so that the piloted end of the shaft will run true in its bearing



Assembly of the transmission begins with placing the transmission-case extension, mainshaft and certain gears on conveyor trays with specially designed wood compartments. Pieces may be removed for pressing in bearings and fitting snap rings, but they are returned to the same tray because the gears are matched, and the low and reverse gear is a selective fit with the splined mainshaft. The conveyor eleminates trucks that formerly cluttered the department, saves floor space

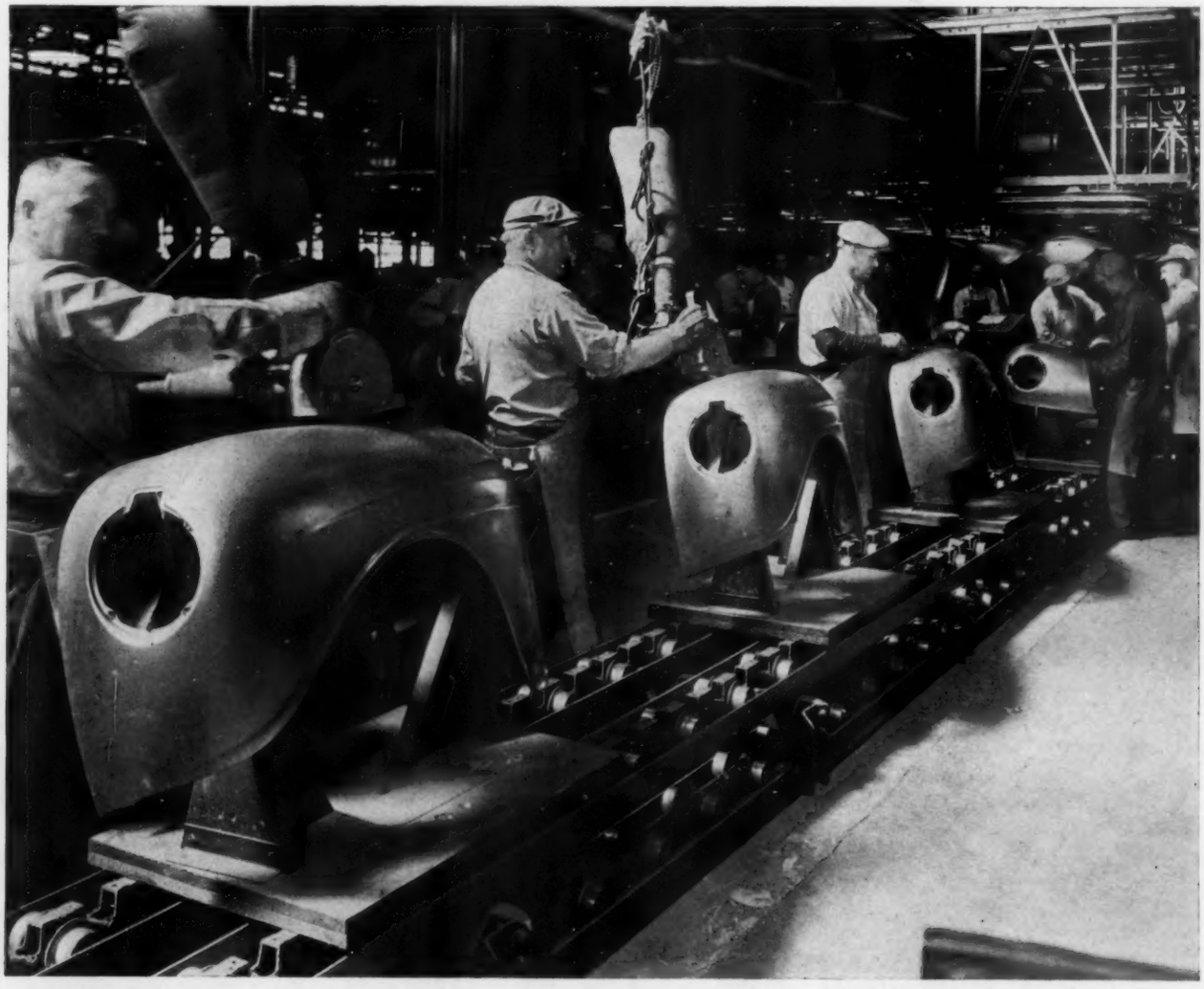


PLYMOUTH PLANT

IMPROVEMENT of assembly methods has been one of the chief aims in Plymouth's revamping process for the 1940 production season. Miles of conveyor have been rerouted or installed, and entirely new methods of conveyorized assembly have been devised for a number of operations. In addition, a multi-cylinder hydraulic riveting machine plays an important part in assembling two stampings and thereby assists final assembly operations. And of course there are numerous other examples of equipment installed to reduce unnecessary handling.

Fenders of the size used on the 1940 Plymouth are bulky for handling by one man at a two-wheel polishing stand. Moreover, fenders used to pick up some scratches and dings during handling on and off benches for metal finishing. These considerations led to installation of over-and-under chain conveyors fitted with wood bucks upon which the fenders are placed for dinging, filing and coarse and fine polishing as they pass a number of workmen. Two conveyors are installed for right and left fenders, respectively.

Each buck is mounted in trunnions so that the fender can be rotated by the operator to bring the blemished surface under his hammer, file or portable electric polisher, as the case may be. Each polisher is suspended on an overhead balancer to take the weight of the machine from the operator's arms and leave him free to guide the wheel only. A dust-collecting bag and powerful suction blower remove particles of metal or dirt.



About 25 per cent of the dings and scratches that formerly were polished out, are avoided by using a straight-line conveyor fitted with wood bucks to carry the new fenders through the metal finishing operations

WHEEL SUSPENSION

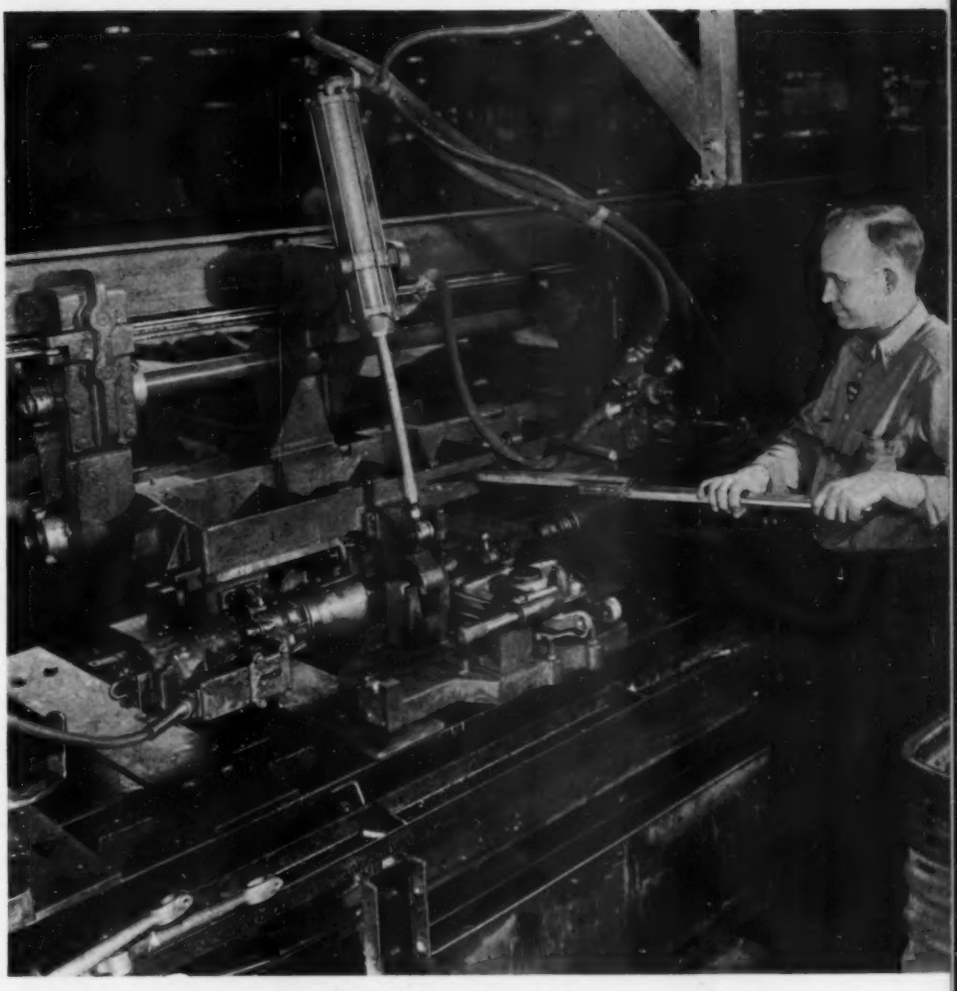
Another notable example of conveyorized assembly has been developed for the lower control arm of the independent front-wheel suspension mechanism. Formerly the operations of running threaded bushings into these arms to hold the pivot bar were done on a bench with simple fixtures and portable nut runners. But the 1940 method embraces a conveyor fitted with 83 fixtures for the right-hand control arm assembly, and a like number of fixtures for the left-hand assembly. This conveyor is also set up to add the steering knuckle support and the brake support assembly.

Each fixture carries locating means for the stamped lower control arm. Hardened threaded bushings are

loosely entered in the reamed holes in the part by hand before the fixture reaches the running-in station. Here a monorail suspends two "high-cycle hangers," each of which is fitted with two opposed high-cycle nut runners. These hangers are free to travel with the fixture as it moves along on the conveyor.

The operator trips an air valve, lowering the hanger so that a heavy pneumatic clamp engages a locating pin held horizontally by uprights. This locating pin establishes the correct height of the nut runners with respect to the threaded bushings, and the clamp fits around the pin and against the supports so that the hanger must move in synchronism with the fixture.

The fixture also has a space to hold the steering knuckle support. A threaded bushing is loosely inserted in this part, which is positioned in the lower control arm at a later station, and the bushing driven by a portable high-cycle nut runner supported on a balancer. At succeeding stations the brake support assembly is assembled to the steering knuckle support with king pin and bearing pin. After adjusting the brakes, assembling the upper support arm and inspection, the suspension mechanism is removed from the assembly conveyor for transport via overhead chain conveyor to the final car assembly line.

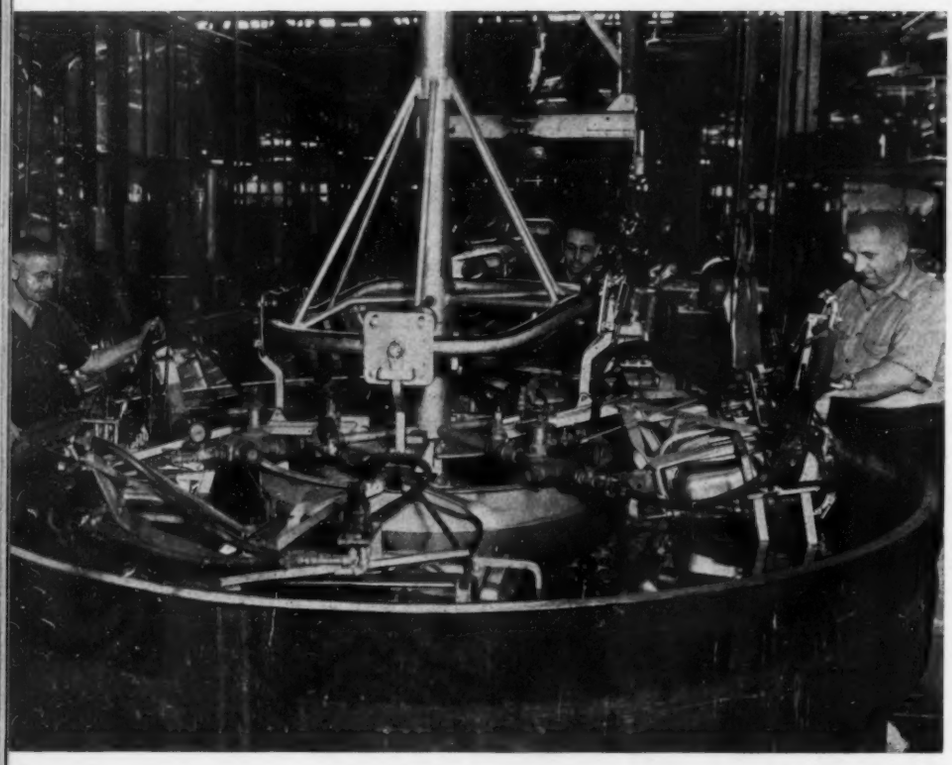


A "high-cycle hanger" suspended on a monorail is in reality an assembling machine for running-in two threaded bushings in the lower wheel-suspension control arm. The hanger is lowered to the conveyor fixture by air hoist and properly registered before the opposed high-cycle nut runners are advanced to the bushings by a long lever

HYDRAULIC RIVETING

A more "squarely" riveted assembly of cross strap to radiator support stamping is secured by a four-cylinder riveting machine that drives eight $\frac{1}{4}$-in. rivets cold, two rivets per cylinder. Formerly this job was done on single-anvil riveting hammers and a punch press, but the new method affords a better product from the standpoint of installation ease on the final car-assembly line.

The cross strap is assembled on a bench to the radiator support with loose rivets. These parts are then laid on a fixture that can be rolled into the riveting machine. A limit switch prevents tripping the cylinders if the rivets are not in line with the tools.



WATER TEST FOR GASOLINE TANKS

A water trough that actually moves with the gasoline tanks as they go through a leak test is installed at Plymouth this year so that telltale air bubbles will not be obscured by movement of tanks through the water. Four fixtures provide stations for loading, testing and unloading the tanks. A stationary cam on the center column moves the tanks in and out of the water

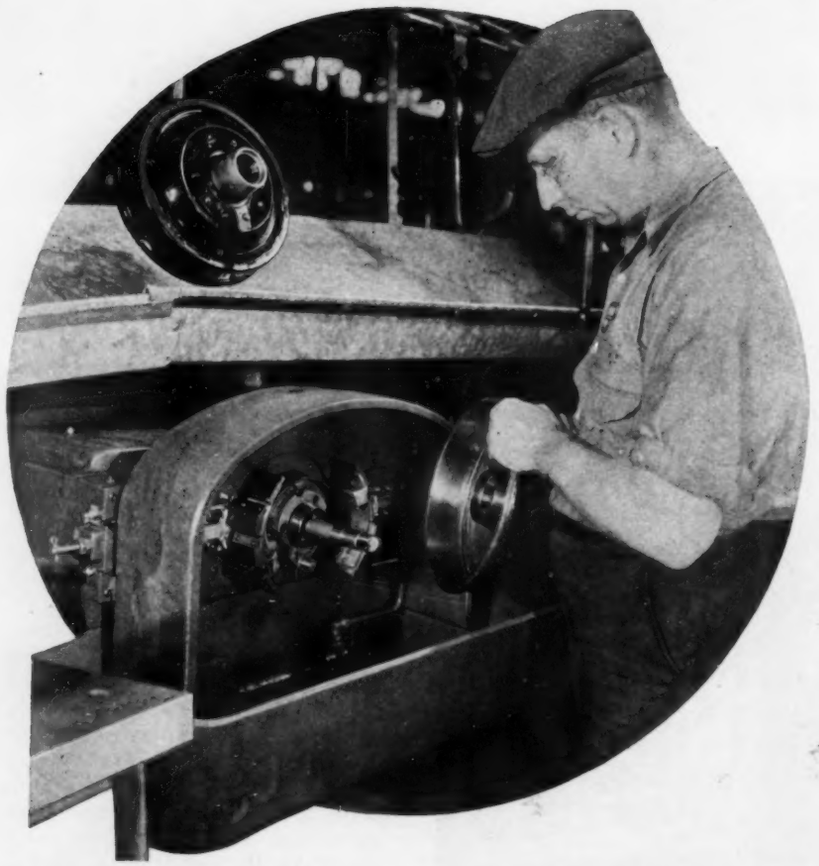
BRAKE DRUM SUPERFINISHING

Plymouth's installation of five horizontal, single-spindle brake-drum Superfinishers marks successful ending of a two-year study to determine the feasibility of this particular operation in large-scale production. Superfinishing the alloy cast-iron drum braking surface adds materially to the life of the lining and increases the efficiency of brake operation.

Efficient stone action is partially obtained by using a coarser feed in finish turning. The finish turning feed is 0.019 in., which results in a good surface for superfinishing on this part. Run-out of the turned drums is ordinarily from 0.001–0.002 in., but the Superfinishing process corrects this condition by approximately 50 per cent. The surface as produced is rated at 15–17 micro-inches on the Profilometer.

Each Superfinisher is supplied with a set of roughing and a set of finishing stones. The drum is held on a tapered spindle that rotates in one direction and also oscillates in and out. Two movements are essential to proper cutting action, and the oscillating movement also has the advantage of preventing circumferential scratches, no matter how fine.

Twenty-five parts of kerosene and one part of a special oil comprise the coolant. This is supplied by gravity from overhead tanks containing filtered liquid. Superfinished brake drums are hung on a chain conveyor for removal to a steam wash cabinet, but must first pass over a trough that collects coolant drippings. These drain into the machine splash guard and run down through discharge piping to an open trench at the back of the machine line, and then into a settling sump. Liquid is pumped from the sump to filters and then to the overhead gravity tanks.



Plymouth brake drums are Superfinished to a Profilometer reading of 15–17 micro-inches, but the process was not adopted until after a two-year study of its feasibility in large-scale production

CHRYSLER-KERCHEVAL PLANT

A NEW METHOD of automatic spot welding bodies at the Chrysler-Kercheval plant spot welds a four-door sedan body at 222 points. It gives uniformity in welding with engineered strength and precision and saves floor space.

The underbody assembly, the right and left side-panel assemblies and the roof assembly are clamped in an assembly fixture. This assembly is transferred into the equalizing fixture of the automatic multi-spot welding machine which not only spot welds the four huge sub-assemblies together, but also assembles the loose dash assembly and welds it in place. Three machines are installed, two for four-doors sedans and a third combination type to handle most of the work on either a two-door sedan or coupe.

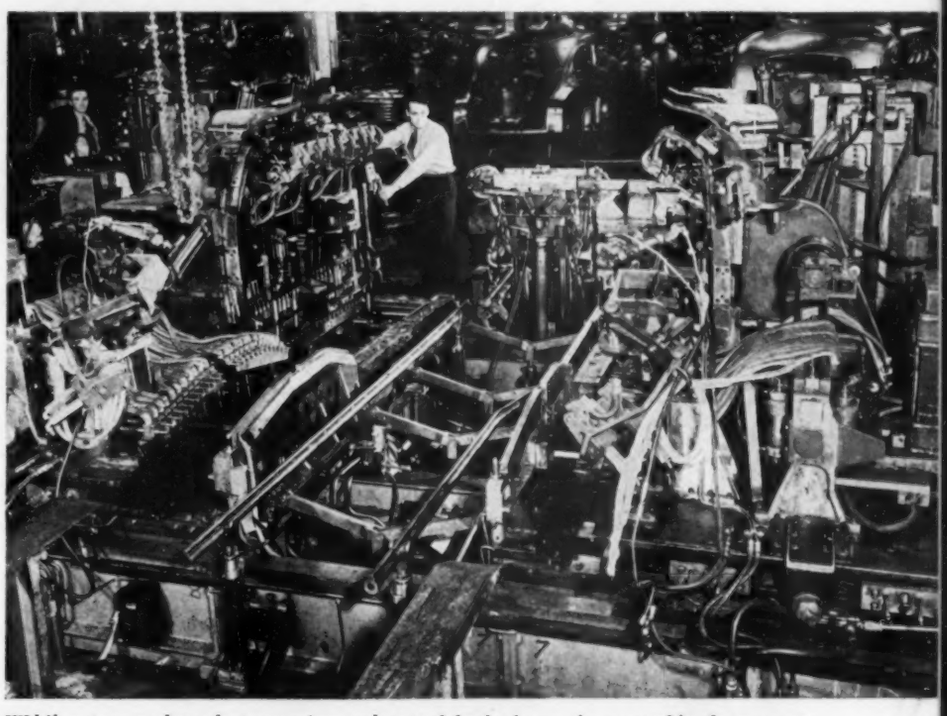
AUTOMATIC BODY WELDING

In the assembly and welding cycle the clamped body is lowered into position on the central, collapsible equalizing fixture. The two opposed side heads, called "slide gates", then enter the door openings and gage them. Immediately afterward two clamping actions take place: (1) Each slide gate has a hydraulically-actuated bar that pivots into the roof rail on the side panel and holds it firmly against the roof. This bar also acts as an electrode. (2) The collapsible fixture has two electrodes which move outward beneath the underbody to clamp it to top and side of the sill on the side panels.

Both clamping actions are independent of the hydraulic circuits (or springs in some cases, which actuate the welding guns. The guns for the roof rail pivot into position, whereas those for the sills have straight-line motion. In all, 60 spot welds are made on each side to join the roof rail and the roof above the door openings and the top and the side of the sill to the floor pan.

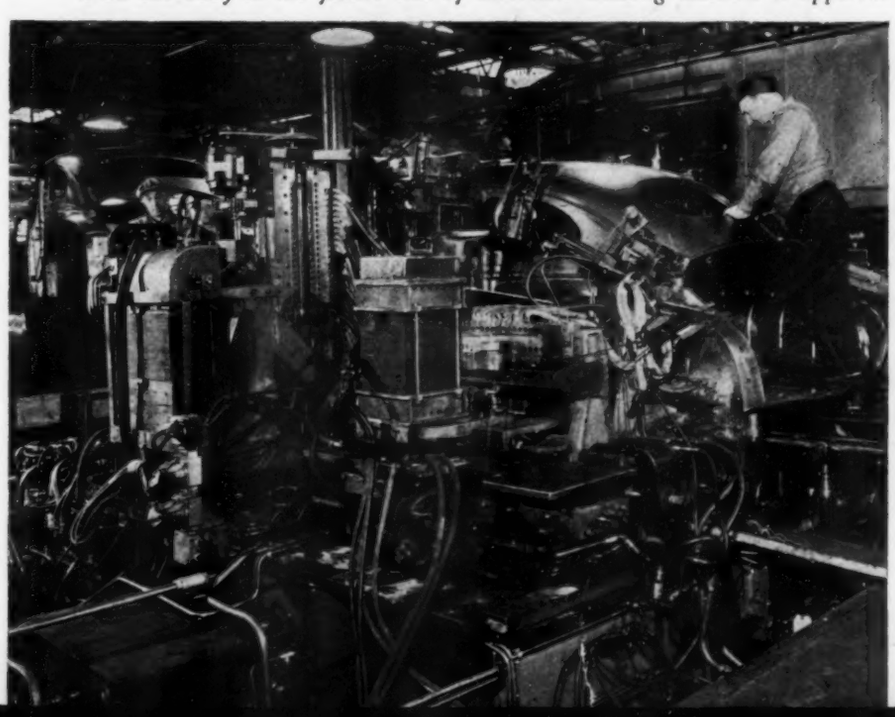
At this point two rear slides advance to clamp the rear wheel houses to the floor pan, each slide making 26 spot welds. A front slide then pivots from a horizontal to a vertical position; thus the dash is assembled into the cowl opening and spot welded in place at 42 points. A vertically moving slide just behind the above pivoting slide moves up to weld the roof cowl top to cowl sides. It expands clamping bars into the cowl sides, rocks the electrodes into position and welds. Four spots are made on each side of the body.

By this system of welding, two guns operate at a time, being connected in series by the electrode clamping bar. The circuit is closed for each pair of guns in turn by a roller moving along a flat commutator, or track. Timing of the welding current is controlled by a limit switch



While open and ready to receive a clamped body from the assembly fixture, not shown, the details of the rear of the automatic welding equipment are visible, such as the two opposed slide gates that position the door openings, the two rear slides that join the wheel houses to the floor pan, and the small vertically moving slide that welds the roof cowl top to the cowl sides. In the center is the collapsible fixture that centralizes the underbody

With the body in the fixture size of automatic welding machine is apparent



fastened to the roller and contacting a series of buttons in turn. These buttons are set to control the welding time at each commutator segment.

AUTOMATIC ROOF ASSEMBLY

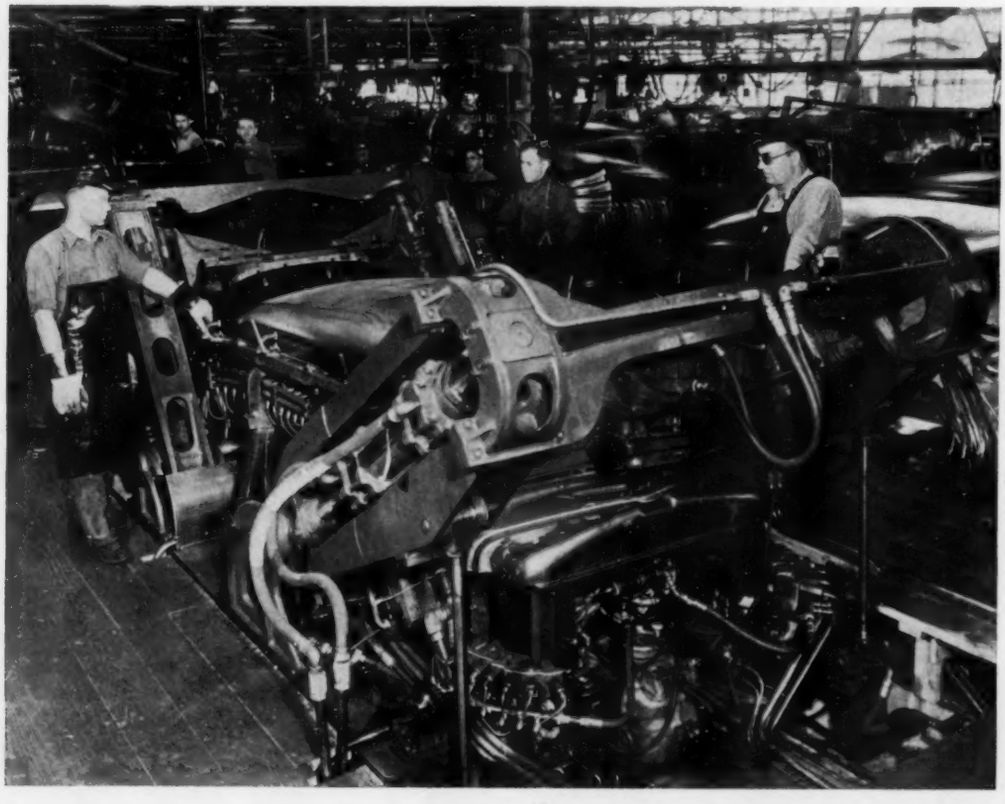
Automobile roof assemblies are commonly made upside down on a merry-go-round conveyor fitted with suitable fixtures, spot welding being done with hand guns. The Chrysler-Kercheval plant has adapted the principles found in its automatic body welding machine to this problem, and now does the assembly work on the roof while it is in the car position. The result is controlled uniformity in the product with engineered precision principles.

Operators first place in the welding fixture the windshield frame, cowl ventilator drain trough, rear window opening frame, and the two side roof drain troughs. Finally, a steel roof is dropped onto the fixture by hoist, and small clamps are placed to hold it in approximate position.

Pivoting clamping members engage the roof at the windshield and rear window openings, the front clamp moves into action prior to the rear one. A locating fixture within the bottom of the machine first rises to center the windshield opening. Then, the piloted clamp in the front clamping member descends and engages the windshield-opening locating fixture, and clamps the roof firmly to the windshield-opening flanges.

Meanwhile the locating fixture for the rear window opening has partially risen into position. After front clamping is completed, the rear-window locating fixture rises to its position. Small wheels in the rear edge of this fixture bear against the back of the window opening and take up the slack in the roof to the rear. Then the piloted rear clamp descends. The roof stamping is now held taut and is located properly over the frames and drain troughs. Several welding machines in the base of the machine spot weld the various pieces to the roof in timed sequence.

The front pivoting slide is ready to place a dash assembly in the cowl opening, where it will be spot welded at 42 points



Spot welding machines work from below to assemble the roof to the windshield opening frame, the rear window frame, the cowl ventilator drain trough and the two side roof drain troughs, producing a uniformly welded roof with engineered principles ready for assembly to other major body parts

Hydraulic Dies

Shells may be bulged, bent or twisted by the application of hydrostatic pressure when the part is held in a two-part die suitably latched

By C. W. HINMAN
Tool Engineer
Kobzy Electric & Tool Mfg. Company

THE OPERATION of hydraulic, or fluid, dies is based on a practical application of the well-known principle in hydrostatics that pressure exerted on any part of the surface of a confined liquid is instantly transmitted undiminished to every part of the liquid.

Hydraulic die work originally meant expanding shells in a closed die by fluid forced into the shell with a hydraulic pump. More modern practice, especially for small work, is to use a press with a long stroke and of sufficient power to exert a pressure of between 1,200 and 3,000 lb. per sq. in. The die is secured on the press bolster plate as usual, and the fluid, which is ordinary cutting compound, is introduced into the open top of the shell.

A Punch of Water

The shell is held securely within the closed sections of a split die. When the press is tripped, a close-fitted punch descends into the mouth of the shell. Water being incompressible, and the walls of the die sections strong, one of two things must happen. Either the shell must be pushed down into the die the same distance the punch entered, or the water must "blow out" the wall of the shell. If the shell rests upon the bottom of the die, the water pressure set up by the ram must escape, and in following the path of least resistance it expands the shell within the die walls. If there were no chance for shell expansion in any direction, the effect would be almost like bringing the punch down against solid metal.

The conditions outlined above illustrate the ordinary types of work done with hydraulic dies. Both hydraulic and hydrostatic work have the advantage that only a single die, the interior of which is finished to the shape desired, is necessary. In bending or twisting, the work is done by applying pressure against the inner surface of the bottom of the shell, and the work is pushed around one or more bends or turns provided in the die. Of course, success depends upon the thickness of the metal and the annealed condition of the shell material.

In simple bulging operations, the bottom of the shell rests against the floor of the die, and the top is inclosed in a neck the size of the original shell. When the punch descends into the neck of the shell, the fluid pressure expands the work in all unconfined directions. This expansion continues until the shell walls are solidly against the inner die at every point. There are instances, such as the elbows of certain musical instruments, where both bending and expanding are necessary, but the principle of operation is the same.

Bursting Shells

To ascertain just how far an operation can be carried, we must "burst" the bottoms out of a few shells, or "blow out" their sides. This is necessary only when the first set-up is made. After the punch pressure depth has been found, it is scribed on the punch as a guide for future operations. Of course, if the next lot of shells have different physical properties, or the annealing is not uniform, the same troubles will be encountered as in redrawing shells in ordinary dies.

Like every other art, hydrostatic work has troublesome conditions that must be foreseen. It is evident that to set the punch for the final operation at just the exact height to impress the metal against all the surfaces within the die, and not come down hard enough to injure the press, requires care because safety features are difficult to install. In work where a small mark on the bottom is permissible, a vent hole is provided through the die at the point where the bottom of the shell touches. Use of a vent depends on the thickness of the metal used. The hole diameter should be $\frac{3}{16}$ of the shell diameter at the point. Under excessive pressure, the bottom of the shell will "blow out" through the hole, which acts as a safety valve. Care should be taken that the vent hole points in a safe direction.

Powerful Latch Needed

In designing hydraulic dies, where close-bottom shells are used, the finished form is first worked out in two halves, much like a drop-forging die. The difference is that the halves of hydraulic dies must be hinged and provided with a latching device that, while rapid to operate, will hold so tightly that an internal pressure of 5,000 lb. per sq. in. will not force the halves apart enough to mark the shell. Above the formed body, there must be a long neck the diameter of the outside of the shell. Whether the work is bending or bulging, or both, the neck is necessarily drawn further down into the die when the shell expands. The neck of the die must be long enough to allow for this recession of metal, plus from one-half to one diameter of the punch. The shell, likewise, must be of sufficient length to allow for this recession while the body is expanding. The punch should

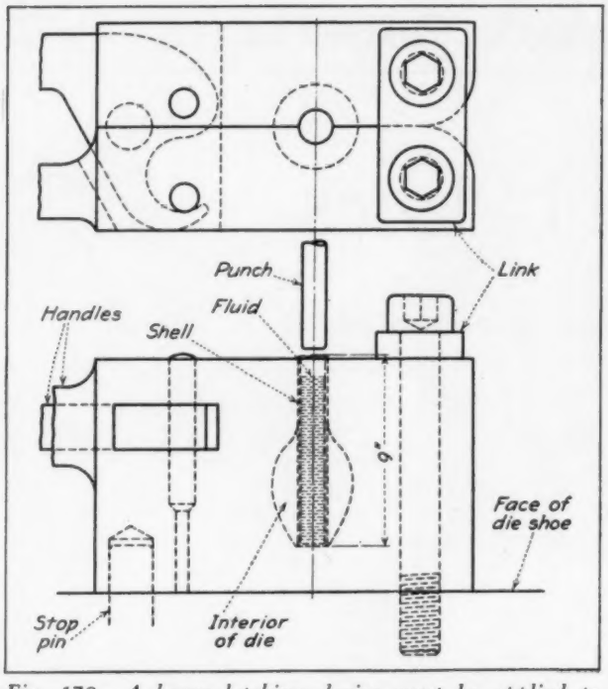


Fig. 178—A heavy latching device must be applied to hinged fluid dies so that the halves of the tool will not spread under heavy hydraulic pressure and mark the shell

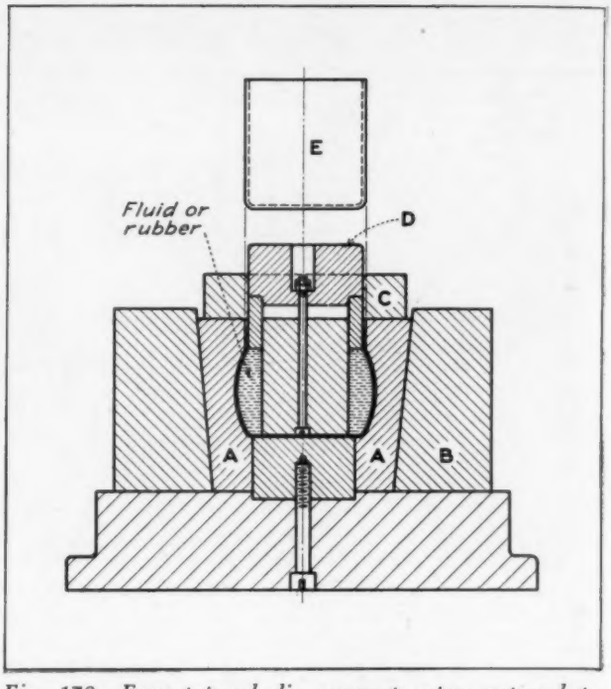


Fig. 179—Four tapered die segments open outward to release a shell that has been bulged by fluid or rubber on a double-action press

fit within the neck of the shell closely, and enter at least half its diameter before expansion begins.

A design for a fluid die of the type just described is shown in Fig. 178. The shell has been inserted between the closed halves of the die, and contains the fluid to be used; the punch is ready to descend and expand the shell. Embossed designs can also be done by this method. The metal enters the letters and lines of the design readily and makes a very satisfactory job.

The material used is high brass, 0.050 in. thick. Five drawing operations are necessary to finish the shell which is 9 in. long. The first draw makes a cup $3\frac{3}{8}$ in. diameter by $2\frac{5}{16}$ in. deep. The second, or first redraw, makes a $2\frac{3}{4}$x$3\frac{1}{4}$-in. cup. The second and third redraws form $2\frac{1}{8}$x$4\frac{9}{16}$-in. and $1\frac{1}{16}$x6-in. cups, respectively. The fourth and final redraw is $1\frac{1}{4}$ in. diameter by 9 in. long. The wall thickness of the finished shell is 0.040 in. This leaves a bottom slightly thicker than the sides. Deep redrawing operations are done on a rack-and-pinion redrawing press.

When using a hydraulic press for expanding and bending simultaneously, it is necessary to use differential pressures. A piston must be provided to push the shell down into the die as it bends or expands, and at the same time sufficient pressure must be maintained inside the shell either to prevent its collapsing while bending or to expand it. When the piston pressure is too great the shell will buckle or collapse, while too great an internal pressure will cause the bottom of the shell to burst. The rate of water admission must also be controlled.

Hydraulic dies for twisting and bending long tubes, and for expanding parts such as artificial limbs, must necessarily be designed horizontally. For artificial legs, Duralumin or Dow Metal are used to obtain light weight. The thinnest tube that will withstand the strains is used. The difference in diameters between the ankle and calf is so great that a tube of the ankle size cannot be expanded enough to meet the requirements of the calf. Therefore, the usual practice is reversed and a tube of the calf diameter is used and spun down roughly, before expanding, to conform to different diameters of the leg. City water pressure is introduced at one end and is closed when the form has been filled. In this case many different sizes and lengths of legs are necessary and the press must be very wide and heavy to accommodate the various lengths and sizes.

Grease or wax are often substituted for fluid in certain types of small work. In other cases, soft rubber is used. An illustration of an expanding die in which either a fluid or soft rubber can be used is given in Fig. 179. This die is used in a double-action press. The die itself is composed of four tapered segments *A* which can be closed together within ring *B*. The blank holder ram is attached to ring *C* and descends first, and this action closes the die segments. The expanding punch *D* follows and compresses the fluid or rubber, and completes the operation. When soft rubber is used, it is of tubular form and is stretched by forcing it onto the punch. Above the die is a sketch of the drawn shell *E*, as it appears before expanding.

Part 29 of Mr. Hinman's series will be published in an early number.

Visitors Welcome

By H. M. LANE

I do not know whether the old inscription is still there, but at Professor John Sweet's Straight Line Engine Works, in Syracuse, New York, over the front door in large letters were the words, "Visitors Welcome." Unlike most lettering in stone, the letters were in relief, standing well above the surface of the door lintle.

When asked about the sign, Professor Sweet said, "The man that comes after me may not want visitors. If so, all he has to do is to chip off those letters."

The Wedge-Shaped Oil Film Does the Trick

Multiple-shoe spindle bearing developed by Cincinnati Grinders Incorporated with wedge-shaped oil film constantly renewed gives a more rigid and accurate support to the spindle at all times

By JOHN HAYDOCK
Managing Editor, American Machinist

SINCE the earliest days of precision grinding machines it has been generally recognized that the heart of the machine is the grinding wheel spindle bearing. Insufficient rigidity of the spindle and bearing often develop chatter. Wear on the bearing surfaces and occasional seizure resulted in frequent shutdown for adjustment and repair.

Among the many plain bearings used have been the tapered box, the half bearing without cap, the half bearing with cap, or with one or more loading shoes to provide a certain measure of stability in the vertical plane. Many combinations of special bearing materials have been used in an effort to reduce the hazard of seizure under abnormal loads or improper adjustment. With all of these structures extremely close fits have been necessary between the spindle and bearings, and consequently precise and sensitive adjusting means and expert manipulation were necessary.

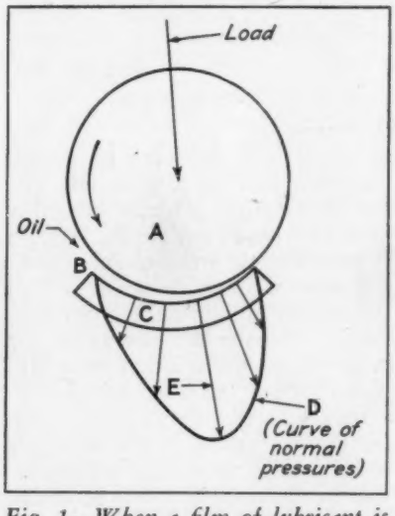


Fig. 1—When a film of lubricant is drawn into the wedge-shaped space between a journal and a single bearing segment, pressure is built up and distributed as illustrated

Thus grinding machine designers have always been faced with the dilemma of selecting between a bearing which would have long life but low rigidity and one which would have high rigidity but relatively short life.

Referring to the accompanying list of spindle requirements, Item 2 is essential for precision grinding machines, because, under idle conditions the wheel is trued by a diamond or other means, and obviously a smooth true is essential for a smooth grind.

Quick Spark-Out

Rigidity is essential in a grinding machine spindle bearing in order to minimize the likelihood of chatter and feed lines. It also permits a more accurate duplication in plunge cut grinding, and provides a quick "spark-out," thus giving higher speed in the production of accurate dimensions.

The phenomenon of pressure development in an oil film was explained mathematically in 1886 by Osborne Reynolds in his classical paper on the interpretation of certain experiments in bearing lubrication by Beauchamp Tower. In this analysis it was proved that the requisites for the generation of pressure in a film of fluid between two relatively moving surfaces are: adhesion of the fluid to both surfaces, viscosity of the fluid, and ability of the surfaces to form a wedge-shaped space.

When a journal (such as *A* Fig. 1) is rotated in a bearing element, fluid from the "lead-in" *B* is drawn between the relatively moving surfaces because of the adhesion between fluid and journal. Since the fluid must have intermolecular friction, or what is commonly called viscosity, other layers of molecules are also drawn into this space. With continued rotation, the layers adjacent to the journal *A* are moving therewith, while the layers adjacent to the bearing *C* are stationary. It is obvious, therefore, that

Requirements for a Precision Grinding Machine Spindle

1. An uninterrupted fluid film must be positively maintained between the spindle and bearing so as to prevent metallic contact and failure in service.
2. The axis of rotation when running idle must be maintained in a constant position—no fluttering or wavering can be tolerated.
3. Change in position of spindle axis with change in grinding forces must be as small as possible.
4. The bearing must be capable of supporting a load which varies in direction through a wide angle.
5. Frictional losses in the bearing should be substantially independent of applied load.
6. Bearing must be as foolproof as possible, with minimum wear, and must not require adjustment for varying grinding conditions such as finishing and roughing.

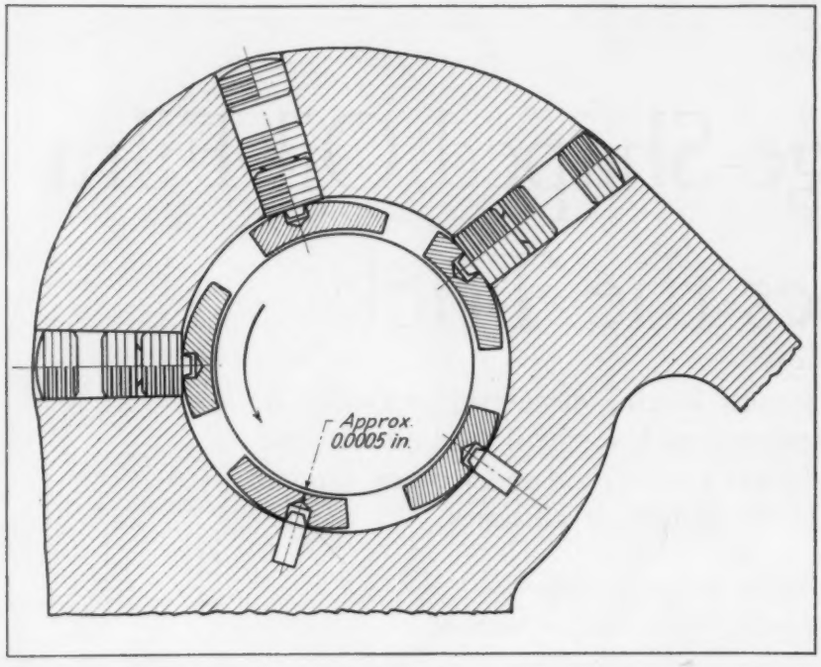


Fig. 2—The entire bearing chamber of the Filmatic bearing is maintained under a pressure substantially above atmospheric

all of the fluid between these surface layers is in a continual state of slip (or shear). When theses surfaces are relatively close to each other, and converge in the direction of motion, the shear forces in the fluid are very great, and thus a pressure is built up normal to the bearing surfaces, supporting the journal and its load, and preventing all contact between journal and bearing.

The distribution of this radial pressure about the axis of the journal is shown by the curve *D*, where the maximum value occurs on the line *E*.

Film Pressure in Plain Bearing

The common journal bearing utilizes this principle of lubrication by developing a wedge-shaped oil film which converges in the direction of rotation, the journal axis being displaced eccentrically in amount and direction in accordance with the amount and direction of the applied load. Obviously, only one converging film can be developed in such a bearing, and thus a somewhat unstable condition results as the position and shape of the converging film changes with every change in amount and direction of the load. Where the oil film is divergent, a subatmospheric pressure may develop, with a possible additional instability due to the induction of air. (For a theoretical treatment of this subject, see "The Theory of Film Lubrication," by R. O. Boswall; Longmans, Green & Company.)

pendent converging oil films which develop high radial pressures, forcing the spindle into a central position.

In the arrangement shown, the spindle is locked in its central position by five "fluid vise jaws" which still permit perfect freedom of rotation with a coefficient of friction almost identical with that of anti-friction bearings. Because of the high preload, and also because of the ability of the shoes to adjust their wedge angle to accommodate the load, the movement of the spindle under a change in load is only a minute fraction of that which occurs in other types of bearings.

Among the first things discovered in the early stages of this bearing research was the explanation of the cause of the hitherto mysterious "pecking" of the diamond in truing. From the early days of precision grinding, the irregular sound of the diamond in passing across the wheel has plagued the lives of grinding machine operators, particularly when taking fine cuts in an attempt to obtain high finishes. These irregular changes

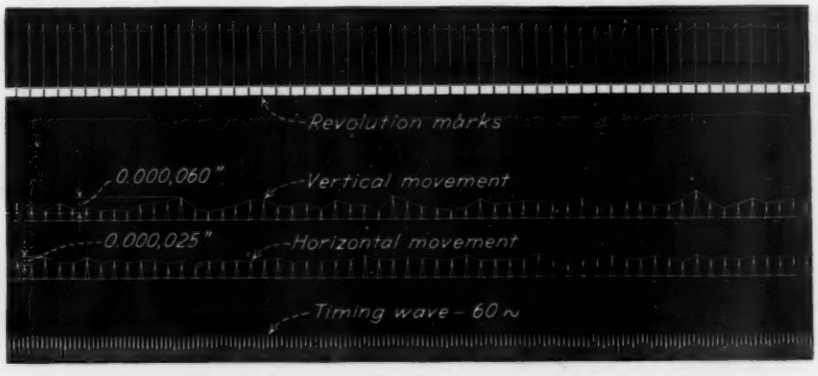


Fig. 3—Old style bearing—60 millionths vertical flutter; 25 millionths horizontal flutter. Tips of the wave peaks indicate the spindle position once each revolution. The irregularity in position of the wave tips in their oscillograth indicates a slight fluttering of the spindle axis

In the past, many attempts have been made to increase the stability and rigidity of plain journal bearings for grinding machine spindles by providing grooves or scrapers so as to interrupt the oil film or to reduce its thickness. This procedure, however, must obviously decrease the carrying capacity of the oil film and must lead in the direction of lower safety and shorter bearing life.

In the "Filmatic" bearing, developed by Cincinnati Grinders Incorporated, and shown in Fig. 2, the instability which is inherent in the single oil film structure is completely eliminated. In this design, three or more separate self-adjusting shoe members are used to produce inde-

in sound were produced by minute changes in position of the spindle axis due to the slight inherent instability of older types of spindle bearings.

Even with the arrangement of rocking shoes as above described to hold the spindle rigidly on a given axis, minute irregular movements on the order of 50 micro-inches were still found to exist. After much patient investigation, these were traced to momentary fluctuations in the oil supply to the bearing shoes, and to the presence of entrained air. This condition was eventually completely eliminated in the Filmatic bearing by maintaining the oil supply in the bearing chamber at a pressure substantially higher than atmospheric and by pro-

viding an effective air bleeder system. Figs. 3 and 4 are reproductions of oscillograph records showing a comparison of the steadiness of rotation of a spindle carried in a Filmatic bearing, and in an older precision bearing of the cap type. The latter bearing was provided with a former standard lubrication system wherein the supply of oil was limited so as to produce relatively thin films.

It will be noted from the curves showing vertical and horizontal displacements in the cap type bearing, that in this case there existed irregular motions of about 60 micro-inches in the vertical plane and 25 micro-inches in the horizontal plane, while in the case of the Filmatic bearing (Fig. 4) the displacements are so small that they are scarcely discernible.

By maintaining the bearing chamber under a pressure substantially higher than atmospheric, it has been possible to provide a relatively simple means for safeguarding the entire spindle lubricating system. This safety

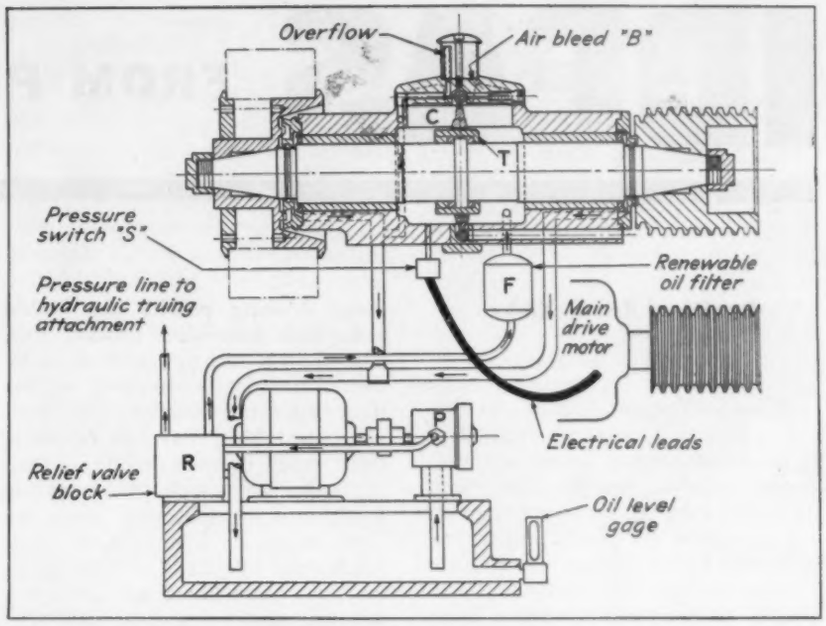


Fig. 5—Cross-sectional view of the Filmatic bearing shows the pressure interlock. The spindle cannot be started until the correct pressure is built up in the bearing chamber

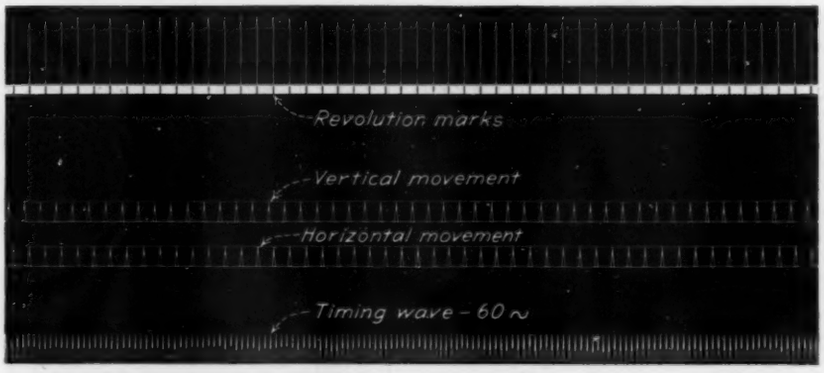


Fig. 4—Filmatic bearing—no discernible spindle flutter. The even alignment of the wave tips in this oscillograth indicates a true running spindle

means comprises a pressure switch *S*, Fig. 5, which acts through a relay to prevent the starting of the spindle driving motor until the desired pressure has been built up within the bearing chamber. An independent motor driven oil pump *P* supplies oil through a filter *F* to the bearing, while a relief valve *R* maintains the chamber pressure at the desired value. The large central oil chamber *C*, which surrounds the thrust bearing *T* and communicates with the chambers for both front and rear bearings, provides a relatively stationary body of oil from which the entrained air can be readily liberated and allowed to escape through the air bleed *B*. This bearing construction is protected by United States and foreign patents.

Because of the fact that, in this bearing, an uninterrupted oil film is positively maintained between the journal and bearing surfaces, its operation is virtually independent of the materials used for journal and bearing and the nature of the lubricating fluid.

The present standard construction employs a chrome-nickel steel spindle and steel bearing shoes lined with a high lead bronze, identical with that used in certain airplane engine bearings, but satisfactory operation has also been experienced with various other types of bronze, and even with cast iron and phenolic-resinoid bearings.

Similarly, the lubricating fluid used is not critical, but may vary over a wide range of viscosity and composition. In actual practice it has been found possible to grind successfully with lubricating fluids ranging from 30 sec. Saybolt to 200 sec. Saybolt on the same machine without even readjusting the bearings. In fact, almost any petroleum derivative, water emulsion, or other non-corrosive fluid may be used with these bearings as a lubricating medium.

In the operation of a large number of machines equipped with Filmatic bearings, some of which have been in service over a period of five years, it has been found that all of the requirements listed in the earlier paragraphs have been fulfilled. These machines have ranged in power from 3 to 75 hp., and in speed from 1,000 to 10,000 r.p.m.

In these machines, the sound from the truing diamond is absolutely uniform, simulating the tone produced when tearing a fine silk cloth. The entire bearing structure is so rigid that the ideal wheel for a given job is usually from one to two grades softer than with the older machines with other designs of bearings, thus giving more efficient grinding with consequent less frequent wheel truing and longer wheel life.

Friction horsepower, with these bearings, is virtually independent of the applied load. In actual operation it has been found that, over a wide variety of work, it has not been necessary to make adjustments when changing from heavy roughing cuts to fine finishing cuts. Maintenance cost of these bearings has been virtually zero.

IDEAS FROM PRACTICAL MEN

Drafting Room Kinks

By MARTIN H. BALL

Where T-squares and parallel rulers have no transparent edges it is quite a convenience to use a transparent celluloid straight-edge about 1/16x$\frac{3}{4}$x12 in. on the upper edge of the T-square or parallel ruler, as shown in Fig. 1. By the use of such a straight-edge the draftsman can plainly see the parts of vertical lines where he wants to start and finish connecting horizontal lines.

The edges of the center openings in triangles can be filed to such angles and tapers as are frequently used in certain classes of work, as shown in Fig. 2. Some of the angles the writer has added to his triangles rather than use a protractor are: 2 in. per ft. for channels and I-beams; $\frac{3}{8}$ in. per ft. for the threaded ends of pipe and for the helix angles of nearly all threads. While that angle may not be strictly accurate for all threads, it makes clear whether the threads are right- or left-hand. Also, 82 deg. included angle for the heads of flat-head machine screws and $\frac{1}{8}$ in. per ft. for standard taper pins have been added to the writer's triangles.

I often wish some one would make drawing pencils that would make lines more black and less gray. The farther such a trend could be carried the better, so long as the lines were not smudgy. However, very good blueprints can be made from pencil drawings made on tracing paper with such pencils as are available if the following points are kept in mind: Figures and arrow heads should be made with the greatest care; short lines and their terminating points should be made very clear, otherwise they are apt to be misunderstood. Circles are not so likely to be misunderstood and can be made with a slightly harder pencil, which helps since it does not require sharpening quite so often as does a softer pencil.

When the size of a blueprint makes it necessary to fold it for compactness, it should be folded with the face out and so soon as convenient after being made; if possible while still slightly moist. The fold will then take its shape with the least amount of injury. The crease should not be pressed too hard and the folding should be carefully done, selecting a place for the crease where the print is most clear of lines and figures, even though it may not come in the center nor be at a right angle. Folding as outlined adds much to the life of a blueprint, since figures and arrow heads are not at the fold where the print is most likely to become soiled or torn.

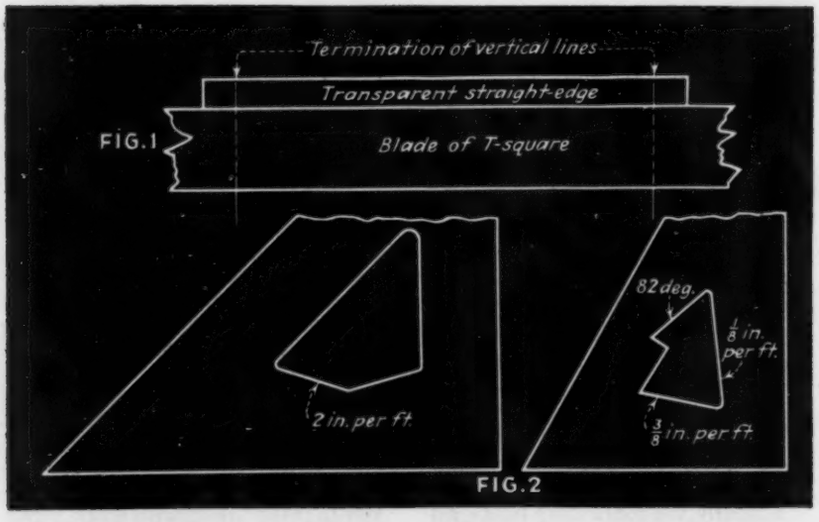
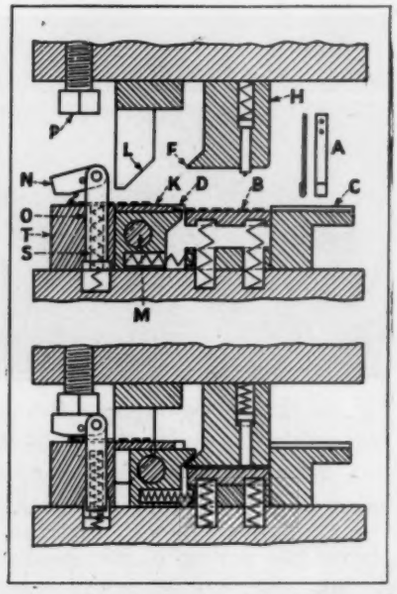


Fig. 1—A transparent straight-edge held against the upper edge of the T-square enables the draftsman to see the terminations of vertical lines. Fig. 2—Openings in triangles can be filed to special angles and tapers

Press Tools for Bending and Flattening

By STANLEY BALDWIN

The press tools illustrated are for bending and flattening one end of the part *A*. The part is made of thermostatic metal and one end is folded over and flattened to bring the Invar side next to the contact point in the device in which it is to be used. The tools are mounted in an inclined press so that the blanks will be fed by gravity. The drawing shows the tools in the open position in the upper view and in the closed position in the lower view. All fastenings, such as screws and dowels have been omitted to avoid confusion of lines.



One end of the blank is bent and then flattened against the body in these tools mounted in an inclined press. All feeds are by gravity

In operation, the blank *B* is fed

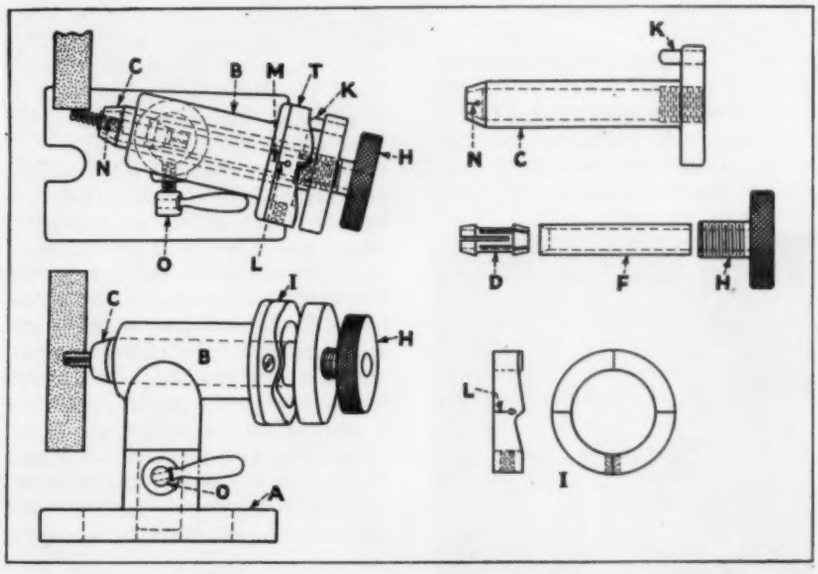
into the chute *C* and slides by gravity against the stop *D*. The press is then tripped and as the ram descends, point *F* on punch *H* passes point *I* on slide *K* and bends the end of the blank to a right angle. As the ram continues its descent the face of cam *L* contacts the flattened side of pin *M* in the slide and causes the slide to move to the right and increase the bend to 135 deg. from the horizontal. On the upward stroke of the ram the blank clings to the point of the punch until it is clear of the die, when it drops from the punch and slides through sheet-metal guides (not shown) until it is stopped by the pivoted flattening member *N* which swings freely on its pivot in the spring-actuated plunger *O*. When the press is tripped the second time, the head of screw *P* contacts the assembled members *N* and *O* as the ram descends, forcing them downward against pressure of the spring *S* just enough to flatten the bent end of the blank against the body on the anvil *T*. The part is prevented from clinging to the anvil by the action of a very thin leaf spring (not shown) so that it slides off the die by gravity and makes room for the next blank. After the second downward stroke of the ram a part is finished at each succeeding stroke.

Machining a Long-Radius Arc

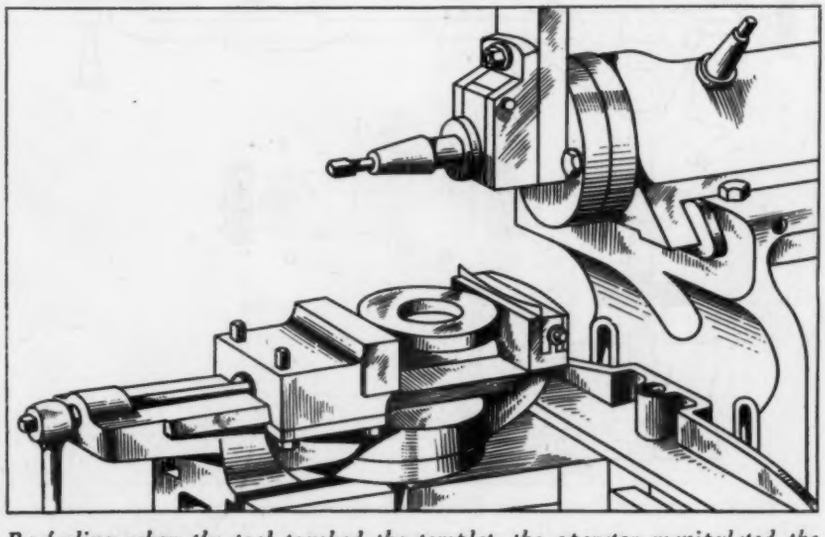
By C. O. HAGEN

Some 8-in. pipe flanges were to be machined to fit the shell of a round tank 16 ft. in diameter. Ordinarily such a job is done by the cut-and-try method, but we made a templet for guiding the tool.

The flanges were held in the shaper vise, resting on parallels, and a templet having a curve of the required radius in its bent-up edge was attached to the stationary jaw of the vise by screws at both ends, as shown in the illustration. With the horizontal feed engaged, the vertical feed was operated by one hand, while a finger of the other hand rested against the templet. Thus the operator could feel when the tool was just touching the templet and could manipulate the vertical feed so that the tool, driven by the horizontal feed, would follow the curve of the templet. Three cuts across each flange finished the job.



Taps held in this fixture mounted on the table of a grinder will have their front cutting edges sharpened and a uniform relief ground on their lands



By feeling when the tool touched the templet, the operator manipulated the vertical feed so that the tool followed the curve of the templet

Tap-Sharpening Fixture

By HERBERT M. DARLING

Production Engineering Department, Leland-Gifford Company

Many shops purchase expensive high-speed steel taps, but after the first sharpening do not obtain satisfactory results from them. That is often due to free-hand sharpening, causing irregular cutting edges having improper relief. To overcome the trouble it is necessary to hold the taps in a fixture that will keep their end cutting edges concentric with the threaded part and have uniform relief.

The fixture illustrated is intended for sharpening machine-screw taps and taps of fractional sizes up to 5/16 in., inclusive. Essentially, it consists of the base *A;* the swiveling head *B* which is bored to receive the quill *C;* the spring collet *D* having a taper at each end; the pusher tube *F;* the closer screw *H;* the relieving cam *I* having the same number of rises and falls as there are flutes in the tap to be sharpened; and the cam follower *K* which is held in the flange of the quill.

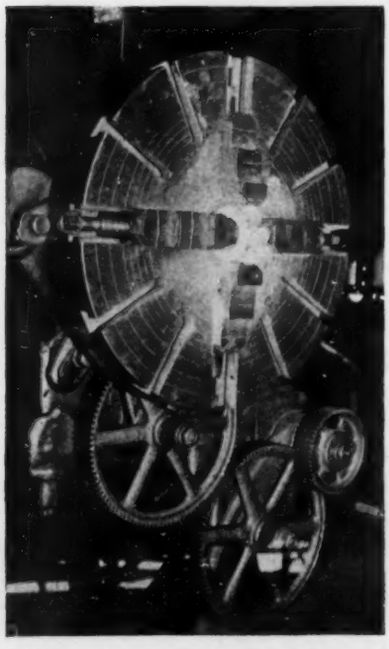
In preparation for sharpening a tap, the relieving cam is put on the swiveling head so that its zero line *L* coincides with the zero line *M* on the head and is locked by a setscrew. The spring collet is put in the quill, being followed by the pusher tube and the closing screw, and the assembly is put in the swiveling head.

In operation, the fixture is mounted on the table of a small tool or cut-

ter grinder and the tap is put in the collet so that one of its cutting edges will coincide with the zero line *N* on the quill; the collet is tightened on the tap by the closer screw. The swivel head is turned to the correct angle and is locked by the screw *O*. The grinder table is moved to bring the tap to the face of the grinding wheel. The quill is slowly turned and at the same time is pressed gently forward by the knurled head of the closing screw to keep the cam follower in contact with the cam. Feeding the tap to the grinding wheel results in grinding a uniform relief on the lands at its ends, as well as sharpening the front cutting edges.

Two Chucks Increase Lathe Capacity

The job shop of Edwin Kilbourne, Ashland, Ky., has been handling all sorts of jobs for many years. To enable him to turn pulleys up to 4 feet or over, he had a special lathe spindle made to take a chuck at the back end,



This chuck, mounted on the back end of the lathe, is used to face large pulleys

as well as the front. The chuck is shown in place in the illustration.

With this chuck and a floor stand fitted to feed a tool across the face, large pulleys can be turned as well as in a lathe that would swing them in the regular way. The chuck does not interfere with the gear train in any way, and adds greatly to the capacity of the lathe and the shop.

Dial-Indicator Attachment

By HANS GALLANDT

In using a dial indicator slidably mounted on the vertical rod of a surface gage, it frequently happens that it is moved either too close or too far from the work. For that reason I have designed and made the sensitive attachment illustrated.

The bracket *A* carries the stud *B* which has a crosshole for the vertical rod of the surface gage, and to which is pinned the wormwheel *C* having 48 teeth of 50 pitch. Stud *B* also carries the sleeve *D* by which the assembly is locked to the vertical rod of the surface gage when the knurled nut *F* is tightened. The upper part of the bracket carries the shaft *H* upon which the worm *I* is tightly pressed. When shaft *H* is rotated by the knurled knob *K*, the whole assembly is caused to rotate about the stationary wormwheel *C* as a center, carrying the dial indicator with it.

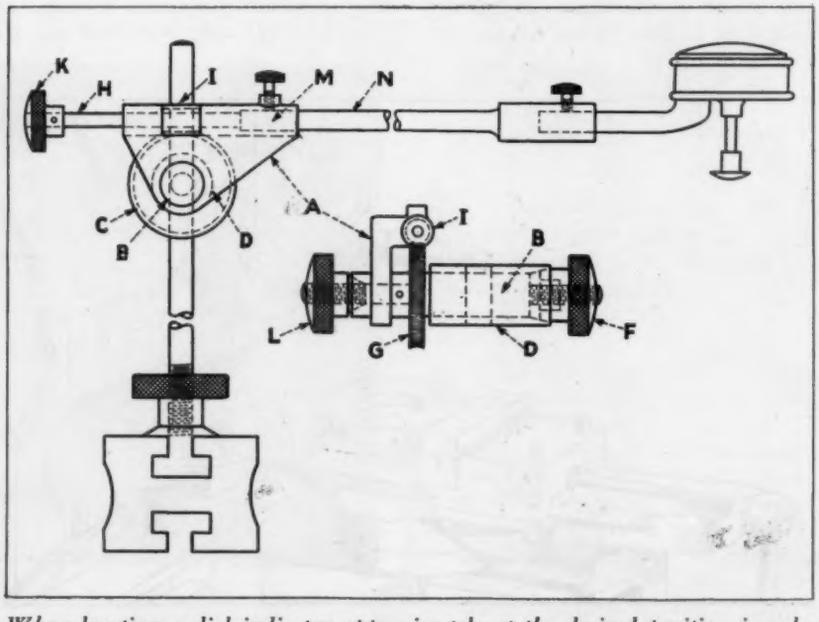
When the assembly is moved up or down on the vertical rod of the surface gage and is at the point where fine adjustment is necessary, shaft *H* is rotated by turning the knurled knob *K*, rotating the assembly until the indicator is in the required position. The adjusting mechanism is then locked by the knurled nut *L*. Ordinarily the dial indicator is attached to the bracket at *M*, but when the work requires a longer reach than is customary, the extension rod *N* is interposed between the indicator and the bracket.

Wire inserted through the hole in both parts of the shears when they are partly open will be cut off when they are closed

Wire Cutter from Shears

By CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

Ordinary shears can be converted into a wire cutter for cutting off the ends of light wire in making electrical connections by simply drilling a small hole through both parts just behind the pivot screw, as shown in the illustration. The hole should be drilled when the shears are partly open so that wire inserted through the hole will be cut off when they are closed. Thus abusing blades for cutting wire is avoided.



When locating a dial indicator approximately at the desired position in relation to the work, close adjustment is made by worm gearing of fine pitch

Check List for Die Designers

Courtesy of the Moore Special Tool Company

ONE way to improve the quality of finished dies is to keep a record of any and all punch and die failures for use as a reference by the designer, die-maker and inspector, thereby preventing the recurrence of previous mistakes in design. Although the causes for die failures are many, it has been found that about 50 of the more common failures probably cover 98 per cent of the total.

The following list is made from such a record of die failures. It is arranged in numerical order, each number being a reference to the die shown in the accompanying drawing. When studying this design, bear in mind that an attempt has been made to show as many different types of construction as space will permit; in practice, some of these details would not be necessary.

1. SPRING LIFE. Spring failure is common, but when springs of ample length and strength are used, little trouble is encountered. The average spring can be compressed 25 per cent of its free length safely.

2. REMOVABLE PILOTS. If possible, pilots should be removable, as shown in the drawing, to facilitate grinding the punches.

3. PROVISION FOR GRINDING. The spacer pieces shown provide a means of keeping the relative length between these two punches and the rest of the punches by grinding the same amount off each at each sharpening of the tool. There are many conditions such as this, and various ways of getting around them. Each should be studied and the best method selected.

4. THICKNESS OF PUNCH PLATE. Punch plate must be of ample thickness, particularly when punches are not guided in the stripper. Punches of $\frac{1}{2}$ in. diameter cannot be properly supported in a plate less than $\frac{3}{4}$ in. thick.

5. PUNCH SHANK LOCATION. For radial location, a dowel through the head of a punch is more positive than the "dutchman" which goes half in the shank and half in the plate.

6. PUNCH PLATE MATERIAL. As the punch plate is left soft, one is inclined to think it can be made of any material. This is not so, particularly when accurate boring of holes is necessary. The best grade of tool steel should be selected for such plates.

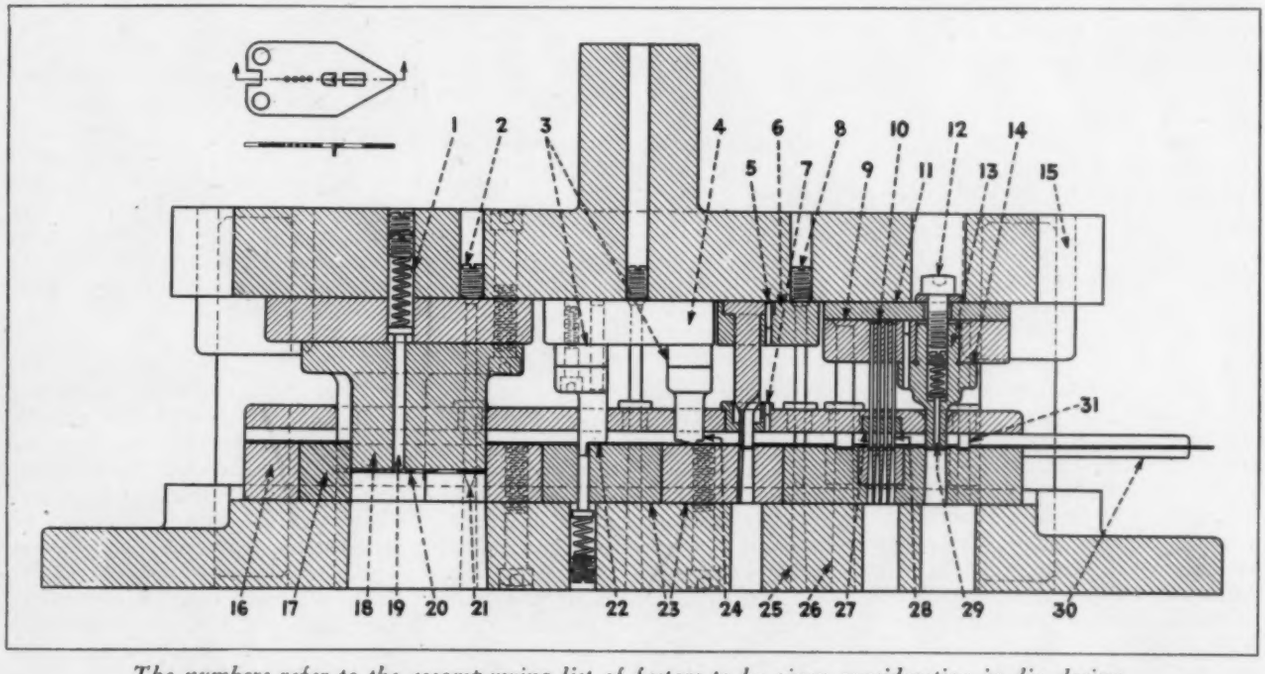
7. GUIDING DELICATE PIERCING PUNCHES. A delicate punch like this must be guided as near as possible to the work. This can be done by a plate set in the bottom of the stripper (see No. 26) or with a bushing as shown. Grinding life is sacrificed to make a punch that will not break in use.

8. SPRING PILOTS. Occasionally it is necessary to put springs behind pilots for various reasons. It should be avoided if possible.

9. PIERCING SMALL HOLES IN THICK STOCK. Piercing punches held in a thick punch plate backed up as shown and guided in stripper bushings will punch holes in material 30 to 35 per cent thicker than its own diameter. The shank, however, should be at least twice the diameter of the hole being punched, and the cutting end must be the hole size for only about two thicknesses of the material. Here punch life is sacrificed to gain strength.

10. ANGLE ON HEADED PUNCHES. About 30 deg. included, angle seems to stand up best.

11. HARDENED PLATE UNDER THE



The numbers refer to the accompanying list of factors to be given consideration in die design

Check List for Die Designers

PUNCH PLATE. This construction is often advisable to keep small punch heads from pounding into the punch holder which will eventually fracture the head, causing the punch to pull out.

12. HOLDING PUNCHES. This method of holding a punch eliminates the necessity of hard driving, and is desirable in some cases.

13. STURDY UNGUIDED PIERCING PUNCHES. It is advisable or best to guide punches in the stripper in most cases. Sometimes it cannot be done very well. In these cases sturdy punches such as shown here will stand up well.

14. GRINDING PUNCH SHANKS. All punch shanks should be ground to the proper drive or tap fit. Drive fits tight enough to keep the punch from pulling out should be avoided. Punches with heads (or screws, see No. 12) need only be a snug fit in the hole, in which case no trouble will be encountered in assembling or disassembling.

15. DIE SET BUSHINGS AND PILLARS. The designer should give some thought to the requirements of the particular die in question. On precision jobs cutting thin stock, extra long bushings help line-up. Four pillar sets are often advisable. A little study on each job will determine what is best.

16. DIE THICKNESS OR LIFE. This is a point to be considered and the designer should note carefully what the requirements are and establish the ideal thickness.

17. INSERT WEAK PLACES. All delicate projections on a die should be inserted for economical replacement in case of breakage.

18. PUNCH LIFE OR LENGTH. This note pertains to the various conditions which govern the practical length of the punches. In general, of course, we like to have enough to allow for many resharpenings. Often punch length must be cut to a minimum to attain maximum strength. This design shows the blanking punch long enough to push each blank clear to eliminate distorting the bent lug.

19. HOLES FOR SPRING PINS. Before hardening of blanking punches, it is well to drill a hole somewhere in which can be inserted a spring pin in cases where blanks pull up.

20. MUST EACH BLANK BE PUSHED THROUGH? Where a blank has a bent lug as shown, the designer must provide a long punch to push each part clear. This is not advisable unless necessary.

21. IS PILOTING CONDITION GOOD? The success of a progressive die depends largely on the pilots. Special holes for pilots in the scrap are advisable in most cases, even though it increases the cost.

22. BENDING WRONG WAY OF GRAIN. The designer will sometimes slip up on this. It is well to have this reminder, because when it happens it is apt to be a costly mistake.

23. HAS THE DIE SUFFICIENT SECTIONS? A separate section for each station is a safe rule to follow when designing progressive dies. Sometimes, of course, even more than this is necessary.

24. SHOULD THE DIE HAVE BUMPER BLOCKS? If the die should accidentally be closed too far with no stock in place, stamps and short-life punches will be damaged. To avoid this, screw one or two spacer blocks in the rear of the die just high enough to fill the space between the die-shoe and the punch-holder (tools closed). This will also make the setting up of the tool an easier task. It is a good rule to put these spacer blocks on every expensive or complicated progressive die.

25. SCRAP HOLES FOR PILOTS. Due to occasional mis-feeds, pilots will push scrap down into the pilot holes; therefore, these holes should be carried all the way through, and taper reamed as shown to allow the scrap to go through.

26. PROPER CONDITION OF SCRAP HOLES IN DIE BED. Just making the scrap holes larger than the slug is not the answer. Slugs have a way of stacking, catching and wedging. Cast-iron die beds may have small blowholes, which make perfect little steps on which these stacks of slugs start piling. If holes are smoothly taper reamed and have no steps or pit holes, the slugs will never jam. Steel bushings can be inserted if a blowhole exists.

27. PUNCHES CLOSELY SPACED. Where space does not permit bushings in the stripper, an insert such as shown should be provided. If precision spacing is required, the location of holes must be corrected after hardening by grinding.

28. WIRE PUNCHES. Much can be said for or against this economical type of piercing punch, which is made of drill rod, hardened, and head-upset or peened by hammering. Although it must be guided in the stripper, it will stand up quite well where the diameter of the hole to be punched is $1\frac{1}{2}$ times the thickness of the stock. If the diameter is less than $1\frac{1}{2}$ times, the head is liable to crumble and the punch will pull out when stripping.

29. SPRING PINS IN PIERCING PUNCHES. As with the blanking punches, it is advisable to provide a hole in which to insert a spring pin in case slugs are inclined to pull up and prevent feeding the strip.

30. STOCK GUIDES. If possible, guide the stock; the length of the guides should be twice the width before the first operation. Rollers, springs and various construction should be used to suit the requirements.

31. KEEPING SMALL PIERCING SLUGS FROM PULLING UP. This note pertains to punches too small for spring pins. Particularly when piercing hard stock, slugs will at times have a tendency to pull back up into their holes, thereby hindering the feeding of the strip. If the hole diameter is two or three times the material thickness, this can usually be stopped by pointing the punch slightly like the point of a nail.

When the ratio is less than this, pointing will not help. However, slugs can be prevented from pulling up by cutting down on the clearance between the punch and die, and making the hole in the die straight (no draft) for about two thicknesses of stock at the top of the die. In real obstinate cases it is necessary to develop the proper clearances between the punch and die by experimenting with different clearances until the slugs stick tightly in the die.

Mobilize For Peace

NOW is the time for industry to mobilize for peace.

Industry has everything to lose and nothing to gain if the United States should become involved in the war. But the man on the street doesn't know that. He has been told that industrialists worked hard to get us into the last war and that they grew sleek and wealthy back in 1917-18.

All the more reason why industrialists should make their voices heard today in behalf of peace.

Already prominent business men are telling the people by press and radio that war does not bring prosperity, but disables industry.

Listen to Howard Coonley, president of the National Association of Manufacturers:

"American industry hates war. War destroys lives and wrecks homes. Economic chaos and years of crushing depression are its inevitable aftermath. It imperils representative democracy. The United States can stay out of war. Emotionalism can betray us into war."

If you are like other industrialists whom I know, you want to do everything you can to keep us out of war. There may be some sincere differences on how we can keep out. At any rate, you may wonder what you can do.

For one thing, you should make your position known immediately to your own employees. In that way you can drive home to them and their families and neighbors, in fact to your entire community, the necessity for mobilizing for peace instead of for war.

The Swartwout Company of Cleveland has taken impressive and effective action. It has sent to all members of Congress a petition beseeching them to maintain peace and reciting the reasons why war would prove disastrous for the United States. The petition was signed by all the company's office and factory employees as well as by the management and directors. All were united in a common cause.

At the end of the Swartwout petition is an invitation to other companies to take like action before it is too late. It is a splendid idea.

Lately we have heard much about industrial mobilization, meaning industry's readiness to do its part in time of war. Thousands of manufacturers have voluntarily tied in with this plan. At this critical time every manufacturer will wish to pledge himself to the drive for industrial mobilization for peace.

Unless mobilization for peace takes precedence over mobilization for war, industry stands to lose its right of self-government, perhaps permanently, and will suffer from its depressing effects for years after the end of a conflict. For, as the Monsanto Chemical Company says, "War means years of blackouts for industry."

Burnham Finney

GAGING BUSINESS

Steady expansion of metal-working industry continues under impetus of war orders and increasing national defense activity. Good business volume throughout winter is likely.

Metal-working plant operations have expanded along a broad front in the past fortnight. The steady pickup in production is traceable to war influences and to gradual acceleration of national defense activities. The federal government alone, for example, awarded contracts totaling almost $70,000,000 to metal-working companies the last two weeks. Export orders have poured in at a steady pace. An increasing number of companies are putting on third shifts. A busy winter looms in all metal manufacturing lines.

MACHINE TOOLS—Purchases by foreign and domestic users have been in large volume, with preference in deliveries being given to U. S. buyers. Some companies are quoting next April as the earliest delivery date on export inquiries. The British and French continue to place orders here. The Dutch also are seeking machines in this country. Though army arsenals and navy yards have bought large numbers of machines, the upsurge in business generally has converted into orders many inquiries from private industry on which quotations were made months ago.

In the automotive field, machine tools have been contracted for by Detroit Transmission Division of General Motors, Dodge and Plymouth. Companies engaged in making wartime products have been in the market. Unable to secure new American machines promptly, Australian companies have bought considerable quantities of used machines for munitions manufacture. With overflowing order books, machine tool builders are devising various means for increasing output without investing in plant additions, one means being to cut down the number of lines offered.

FARM IMPLEMENTS—With crop prices up and both domestic and export demand for agricultural commodities growing, implement makers see better business ahead. Farm income for the first eight months of 1939, at $4,594,000,000 closely paralleled that in the same period a year ago. International Harvester and Deere & Company won't take business at current prices beyond January 1 delivery. Oliver has set December 1 as the limit.

RAILROADS—In the biggest buying wave in years, railroads are spending $65,000,000 for new freight cars and locomotives and over $90,000,000 for repairing thousands of locomotives and 175,000 cars. Huge orders for rails also are being placed. Further equipment purchases are in prospect. Recent awards insure near-capacity operations for most car builders throughout the winter. Electro-Motive Corp. is running two shifts and part of a third making Diesel-electric locomotives.

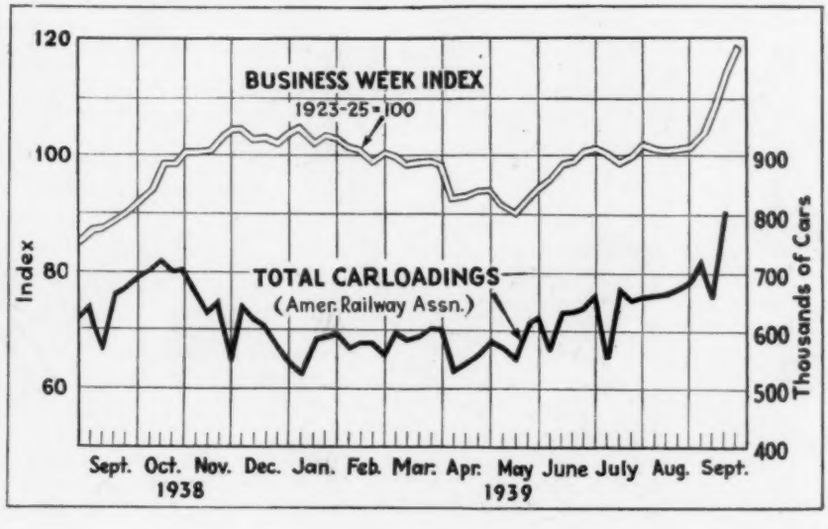
STEEL—Mill operations, now at 84 per cent, are destined to climb higher and to stay at close to full capacity the remainder of the year. Such products as sheet, strip and tin plate are sold out for the fourth quarter, and companies making heavy items haven't much tonnage yet to sell for '39 delivery. Export orders are being taken sparingly so long as domestic bookings continue heavy. Shortage of scrap is the most serious problem at the moment.

SHIPBUILDING—Larger shipbuilding companies are rapidly approaching capacity production, hence are restricting current bids on new ships to what they can handle. Because of inability to obtain commitments from subcontractors, they are refusing to guarantee bids for more than 10 days. Few ways are available on which new keels can be laid down. To put a number of obsolete ways and shipyards back in service would involve substantial increases in costs. The Maritime Commission now has 131 ships on order, being well ahead of its schedule of 500 ships in 10 years.

AIRCRAFT — Backlogs of aircraft makers have been expanded to record proportions by army Air Corps awards totaling $58,585,061. Airplane parts manufacturers likewise have received "windfall" 55 orders in connection with army and navy needs. North American Aviation and Vultee have authorized plant expansions, the former including die and drop forging shops. Northrop Aircraft will spend $500,000 on a new plant at Hawthorne, Calif.

CARLOADINGS VS. GENERAL BUSINESS

The spurt in carloadings and increase in general business activity due to the war are major factors in the decision of many railroads to spend considerable amounts for new equipment (see page 830C)



NEWS OF THE INDUSTRY

RAILROAD EQUIPMENT BUYING SOARS AS FREIGHT TRAFFIC REGISTERS RECORD INCREASE

NEW YORK—Railroads have spent $125,000,000 for new equipment, both rolling stock and motive power, the past 60 days. Further expenditures of $65,000,000 are being discussed.

An unprecedented increase in freight traffic is responsible for this buying wave. Moreover, estimates are that the peak of the freight volume for this year won't be reached until October, and after that the carloadings will continue heavy.

Some of the financing is being done by the R.F.C., but most of it comes from regular banking sources. It is not known how much of the money will go for new shop equipment, but indications are that only a small proportion will be thus spent.

Railroad equipment business is as follows:

Illinois Central has ordered 750 cars from General American, 750 from Pullman-Standard, 500 from American Car & Foundry, 500 from Mount Vernon Car (total of $7,000,000).

Chicago & Northwestern has ordered 500 cars from Pullman-Standard, 300 from Mount Vernon.

Lackawanna will buy 1,100 freight cars, will rebuild 600 cars in its own shops.

The Milwaukee will build 2,000 cars in its own shops, has ordered 10 locomotives from Baldwin (total of $10,000,000).

Pennsylvania will buy 20 electric locomotives and 2,500 cars as part of its $17,000,000 program.

The Erie has ordered 500 freight cars from American Car & Foundry, 400 from Pullman-Standard, 300 from General American and 250 from Greenville Steel Co.

Delaware & Hudson has ordered 500 cars from American Car & Foundry, 500 from Bethlehem Steel.

Wisconsin Central has ordered 200 cars from Pullman-Standard.

Virginian Railway is building 500 freight cars in its own shops in addition to 500 started early this month.

Chesapeake & Ohio will buy 2,500 freight cars.

Union Pacific will build 2,000 freight cars in its own shops, has ordered 100 dump cars and 100,000 tons of rails.

Seaboard Airline has ordered seven diesels from Electro-Motive Corp.

Erie will buy three diesel switchers from Electro-Motive, four from American Locomotive.

Missouri-Kansas-Texas will recondition a number of locomotives in its own shops.

New Haven will buy 250 freight cars.

Youngstown & Northern will order 100 gondolas.

Canadian Pacific and Canadian National will spend $25,000,000 for new cars and locomotives.

Norfolk & Western has bought 750 cars from Virginia Bridge, 750 from Ralston Steel Car, 500 from Bethlehem Steel.

Wheeling & Lake Erie has ordered 400 cars from Pullman-Standard, 100 from Ralston Steel Car.

Bessemer & Lake Erie will buy 2,000 freight cars.

New York Central will buy about 4,000 freight cars.

Elgin, Joliet & Eastern will buy 1,500 freight cars.

Canadian Armament Production Preparations Rushed to Supply Allies with Munitions

DEFENSE ORDERS LOOM LARGE

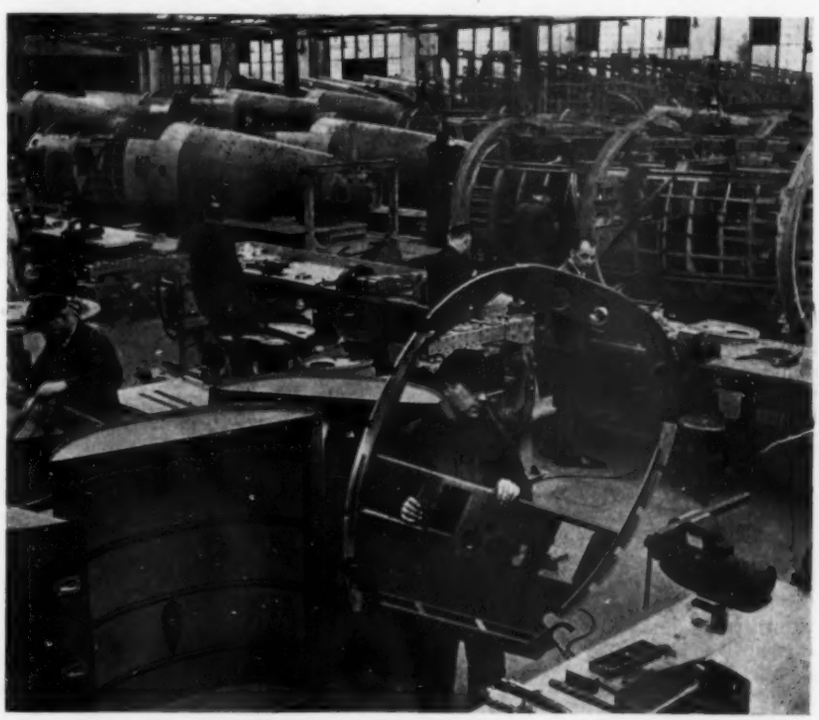
WASHINGTON—General Electric has received a War Department order for $335,348 for sighting systems and another for $836,007 for supercharger assemblies. Other sizable orders are: Scovill Mfg., $112,878 for metal parts for boosters; Caterpillar Tractor, $174,501 for tractors; Essley Machinery, $118,521 for honing and lapping machines; Pump Engineering, $205,067 for vacuum pump assemblies; Pioneer Instrument, $573,990 for drift meter assemblies; Jones & Lamson, $46,752 for turret lathes; B. & S., $38,976 for machine tools.

Navy Department has awarded Vought Sikorsky $1,998,420 for airplanes and North American Aviation, $676,400 for planes.

Actual Manufacture Delayed by Demand for Other Vital Needs

MONTREAL—With more business on their books than they can handle, Canadian tool and die makers are being swamped in anticipation of a heavy volume of war orders from both the Canadian and British governments. Even greater increases in buying are expected, with additional orders from other British dominions helping to swell the total. Assured of large government armament contracts, many companies have been shopping around in the United States and have already placed big orders for tools and equipment.

Actual placement of war orders with private industry has been delayed, since most plants slated for war work have been rushed with other business, and many of them are being



Fighters for the Fatherland—*As for many months past, Germans are still rushing work on hundreds of all-metal planes such as these jammed into a plant "somewhere in Germany." Countries like Canada, however, will require from a year to eighteen months to swing into large-scale plane production*

Checking Up—*Caterpillar Tractor Co. has developed "goggle carts" manned by a special attendant whose job it is to clean, repair and adjust safety spectacles, respirator parts and welding helmets, carts being equipped with all tools necessary for this type of work. Each makes some 125 contacts a day*

allowed to finish up certain important domestic work before converting their plants for armament production. Railway equipment makers, for example, which are being counted on heavily to produce various types of war machines, are speeding through some $25,000,000 worth of government-financed work for the railroads.

Shortage of Skilled Workers

Many tool manufacturers have been hampered by a serious shortage of skilled workers, as many of the best men went to England several years ago to participate in the armament activity there, while others drifted into other occupations during the depression. Many industries are being hard pushed to meet the rush of buying which has followed the rapid rise in commodity prices. In addition, they will be utilized to provide necessary war materials as well—textile mills making uniforms; railway equipment makers producing airplanes, tanks, guns and similar military equipment; automobile companies putting mechanical equipment on wheels; liquor plants making denatured alcohol and other chemicals essential for explosives; kitchenware companies turning out steel helmets, and so on. Already Marine Industries, Ltd., is spending $6,000,000 at Sorel tooling up for munitions manufacture, using the designs of the French armament firm of Schneider-Creusot, whose engineers are now busy at Sorel getting production going.

Most companies have been made aware of the functions they will assume and have been rushing preparations for this work. Although some Canadian government orders have already been placed, bulk of the business is being held up while British and Canadian government exports work out allotments so that each plant gets the work it is best suited to handle. At the start, a large part of the business will be placed in the United States, particularly when the neutrality law is repealed.

Shipping facilities are one of Canada's biggest problems in her role as arsenal for the empire. The government will use its control over foreign trade—requiring licenses for all imports and exports—to prevent imports of all commodities not deemed essential in carrying on the war. Preference will be given imports of British goods to permit building up in Canada of exchange for the purchase of war materials.

The Canadian Parliament has repealed earlier politically inspired restrictions on war orders, and for control of profiteering is relying entirely on the excess profits tax recently rushed through and on the personnel of the newly created buying agency. Heading all purchasing, as chairman of the new War Supply Board (which supplants the old Defense Purchasing Board) is Wallace R. Campbell, for many years president of Ford Motor Co. of Canada. Assisting him is another leading industrialist, Gordon W. Scott, of Montreal, and Watson Sellar, of the government's permanent staff. The new board will direct purchases not only by the Canadian government but those by the British government as well, and possibly later those by Great Britain's allies.

EXPECTED INCREASE IN COSTS MAY CUT SHIPBUILDING ACTIVITIES

WASHINGTON—Two definite threats to continued speed of the Maritime Commission's building program of standardized cargo ships showed up when the latest batch of bids was opened. Newport News, Sun, and Bethlehem, bidding on C-3 ships, all refused to guarantee their bids for more than ten days because of inability to obtain commitments from subcontractors. This situation, unprecedented in the commission's experience, reflects current expectation of drastic price increases. If the expectation proves justified and bids get way out of line, liklihood is that the commission will stop making awards for a while until the situation settles down. The commission is well ahead of its schedule of 500 ships in 10 years and could afford to wait.

Moreover, the commission may have to hold up whether it wants to or not, the bids revealed. Several of the smaller firms participating in the bidding specified that, because of the limited capacity of their ways, if their bids on one class were accepted they would have to cancel bids on another class. Although the larger firms did not qualify their bids in this way, it is known that these yards too are rapidly approaching capacity and the firms are restricting their bids to what they can handle.

Few Shipways Available

In general, there are now very few ways available on which new keels can be laid down. It is true that a number of obsolete ways and shipyards are in existence which could be put into service, but this would involve substantial increases in cost.

These indications of a slowed-up program, of course, are based on the absence of an emergency. Let a real shipping shortage develop or let this country become involved in the war and the ships will be built—if they have to put on three shifts at the Treasury.

Meanwhile the commission is going ahead with its contract awards on the basis of bids previously received. Total number of ships on order was brought to 131 when contracts were made for five C-1, twelve C-2, four C-3, and seven specially designed ships. A contract previously awarded to Tampa Shipbuilding and Engineering for five C-1 ships was cancelled when that company received a contract for four C-2s, since Tampa could not handle both orders.

Awards: Sun Shipbuilding, five C-2 at $2,257,000 and six at $2,277,000; Tampa Shipbuilding, four C-2 at $1,950,000; Seattle-Tacoma Shipbuilding, five C-1 at $2,127,000; Bethlehem Steel, four special designs at $2,430,000 and three at $2,140,000; Ingalls Shipbuilding, four C-3 at $2,550,000.

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Independents stage strong comeback, with most plants operating close to capacity. Rising general prosperity, not lack of competition, is considered chief factor.

DETROIT—A survey of plans of five independent automobile manufacturers discloses that their combined output during the last quarter will approximate 145,000 units, or double their output during Oct.–Dec. 1938. Operations in all plants are now at or close to capacity. Employment is at new high levels. This situation is expected to continue until mid-December, when schedules may slacken by one-third for a few weeks until buying picks up after the severe winter weather passes.

The strong comeback of the independents appears to be induced solely by a rising tide of prosperity throughout the country, rather than to lack of competition from the Big Three. While it is true that General Motors divisions were delayed by the tool and die strike, and Ford is late to announce as usual, the Chrysler divisions have been selling cars faster than they can produce them. The plans of the independents are for a period when competition will be keenest.

Spokesmen for the large corporations have predicted a 15–20 per cent increase in production for the 1940 model year. The inference is that perhaps 4,200,000 passenger cars will be built. But the strong headway being made by the independents leads to the belief that earlier predictions may well be surpassed appreciably.

Hudson's Early Start

Hudson took advantage of the earlier Auto Show this year and shipped 3,661 new models in August as compared with none in August 1938. By Sept. 21 it added 8,062 units as against only 869 in Sept. 1938.

Comparing the first two months of respective production seasons, Sept. and Oct. of 1938 gave Hudson 8,609, as against a probable 14,000 in August and September of this year. The increase amounts to 65 per cent.

But the company estimates that October production will amount to 14,000 units, as compared with 7,740 last October. And the last quarter will probably see 40,000 units made, or a gain of approximately 70 per cent over the 23,668 units made in the Oct.-Dec. period of 1938.

Employment at Hudson has hit a ten-year high, being in excess of 12,500. New lines may be started to keep pace with the demand. Dealer outlets now stand at 2,355, having increased by 176 units since Aug. 1.

Nash sales for the 1940 season are expected to be 50 per cent ahead of last year. August production was 4,915 units and that for September approximately 6,300. Two weeks in September were adversely affected by the Bendix strike, and the plants worked only about half time. Nash should produce at least 25,000 cars in the last quarter.

Packard's sales are 100 per cent ahead of last year, and many orders on the books for several weeks are still unfilled. The dealer organization is expanding rapidly, and at least 175 new outlets have been added to the 1,400 existing prior to new-model introduction.

October production for the Packard plant is set at 14,000 cars, and employment is at a new peak of more than 12,000 workers. Operations on the new model got under way in August, when 8,500 cars were built, September brought an increase to 9,000, although 10,000 had been scheduled. The Bendix strike caused a shutdown for lack of brake parts. No shutdown in October is anticipated because of the local bearing-plant strikes. Large banks of bearings have been built up, and other sources of supply will step in if a shortage is experienced.

By the end of October, Packard will have built 32,500 new cars, or 65 per cent of its goal of 50,000 before the year end. With sales mounting, it is entirely likely that assemblies by Jan. 1 will reach 10,000 more than the projection upon which materials have been bought so far.

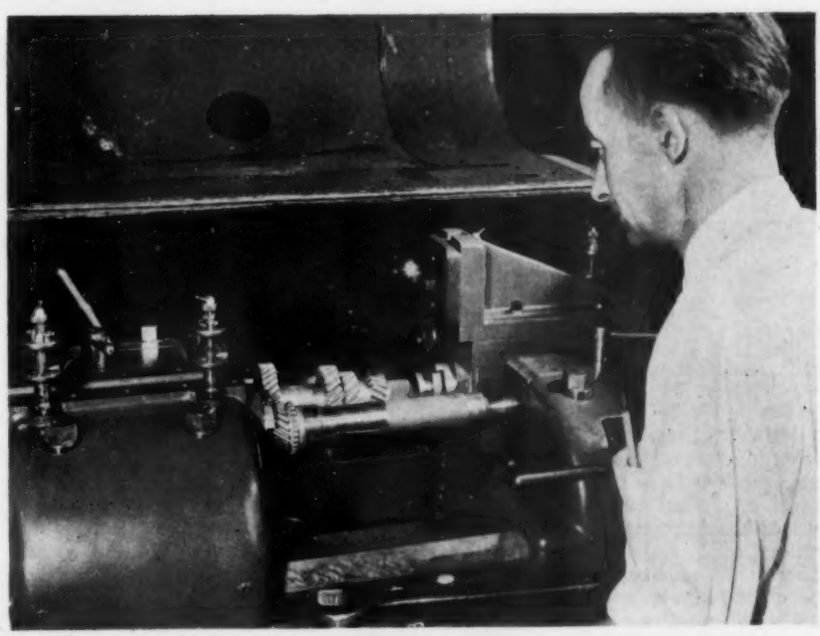
Studebaker at Peak

Studebaker conservatively estimates that the production of cars and trucks during the last quarter will average between 10,000–11,000 per month. Assuming that 33,000 units are built, production for the 90-day period will be 66 per cent ahead of last year, when 19,829 vehicles were built.

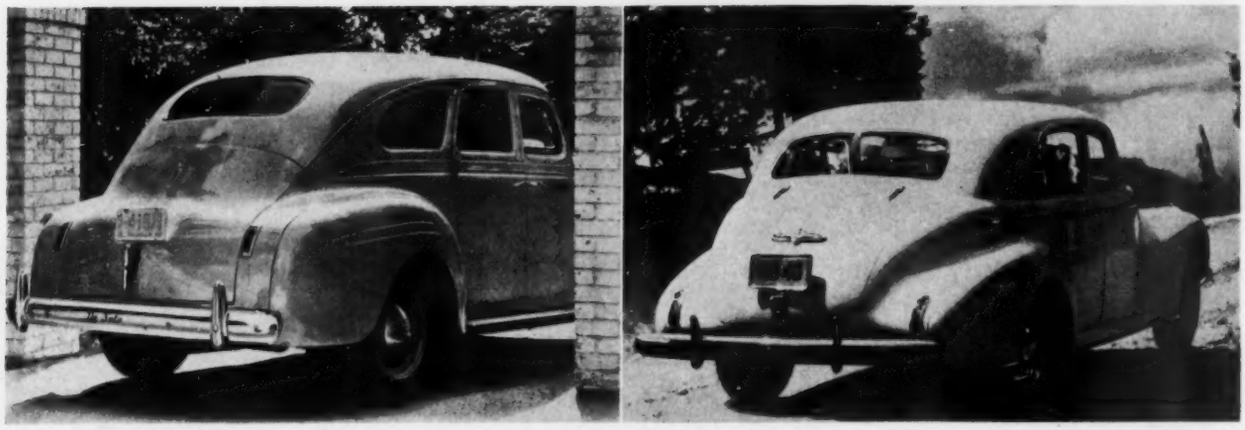
No direct comparison of the rising

BIDS ON BROWNINGS

DETROIT — Chevrolet Steering Gear Division at Saginaw is understood to have submitted a bid for production of Browning machine guns under the educational order program. Equipment dealers have made detailed proposals.



Job-Lot Inspection—*Service gears made at the Chrysler Corp. Highland Park plant for Dodge passenger-car transmissions can be checked for any operating condition on this gear speeder, which is specially built for quick changes in set-up. The machine runs forward and backward, and the load and speed can be varied for checking tooth contact and noise of any pair of gears. An insulated cover shuts out all shop noises and has a "listening hole" in the front*



Rear End Contrasts—*General Motors, as typified by the Buick Series 70 Roadmaster, a car with a specially wide body, right, continues to refine the style trend started with the Cadillac 60 Special. Chrysler lines, as shown by the DeSoto, left, have modified the fast back by an out-flaring contour which increases the underslung appearance. A square-bottomed rear door affords easier access. Both makes feature curved safety glass in rear windows*

tempo of production during the earlier months of the 1939 and 1940 model production seasons can be made because the Champion (non-existent in 1938) was put into 1940 production during the middle of August, whereas the President and Commander lines were not started until Sept. 18. But Studebaker made 10,672 cars and trucks in September, whereas it shipped 6,564 in the same month a year ago.

Studebaker does not give breakdowns of its sales by models for policy reasons, but some idea of the effect of the Champion can be gaged by comparing figures for the first eight months of 1938 and 1939—

Studebaker Factory Sales (all divisions)

	1938	1939
January	3010	4736
February	3117	4802
March	4046	*10208
April	3953	†10974
May	3285	11334
June	3067	11122
July	3456	6416
Aug.	2455	6951
Total (8 mo.)	26,389	66,543

* Stocking dealers with Champion.
† Champion announced about April 1.

Pontiac Adds the Torpedo

Local Pontiac dealers are now showing four distinct lines in a total of seventeen body models. A new bid for the volume market is a low-priced Special Six on 117-in. wheelbase. Deluxe Sixes and Eights come on 120-in. wheelbase, while the Torpedo (the special wide body such as used by Buick on two models and Olds on its senior eight) has a 122-in. wheelbase chassis.

Floors in new Pontiacs are 4 in. lower to afford easier entrance of passengers to body. Front seats are 4 in. wider, but the Torpedo has a front seat 60 in. long. Two or three years ago a 50-in. front seat was thought ample for three people. The Torpedo provides ample room for three in the front seat and gives the driver 11 in. additional elbow room.

New method of body mounting continues vulcanized rubber and cotton shims between body and frame, but adds insulation between frame and hold-down bolt nuts. Rear axle pinion bearing surface is superfinished. Roller bearings replace bronze bushings in the transmission countershaft. Directional stability is improved by floating upper and lower kingpin bushings. These bushings have a bearing on exterior and interior surfaces to prevent galling and resulting hard steering.

Two LaSalles and five Cadillacs give General Motors its most comprehensive spread through the medium and upper price ranges. Only five series were built in 1939.

The LaSalles have frontal resemblance but entirely different passenger compartments. The Special's lines are reminiscent of the Cadillac Sixty Special. New in the Cadillac series is the Fleetwood Seventy-Two, which occupies the bracket between the Sixty Special and the Fleetwood.

PLANS SHELL MANUFACTURE

DETROIT—An independent automobile manufacturer is looking into the cost of machining 105-MM. (4-in.) shells. A major car producer lost the contract for 75-MM. cartridge cases, having figured on 750,000 per month, the order going to Scovill. Work on the 75-MM. shell contract appears laid over indefinitely.

Chrysler Labor

Within two weeks or a month after the Chrysler election, it is expected that the UAW-CIO will make the following demands: sole bargaining, a union shop which may or may not be really pressed, improvements in the grievance procedure. From the CIO viewpoint the steward's power is too strong with reference to that of the shop committees. Also, the union is expected to want at least two representatives present when negotiations are in progress over grievances. Pay raises are likely to be pressed, although in most cases the present rates are considered about in line with those paid by General Motors.

It is unlikely that the CIO negotiations with Chrysler will reach the stage of calling a strike. The men want work; the company wants cars. Doubtless, a new contract will be peaceably arranged.

Packard has been quietly negotiating with the union. One point granted is restoration of seniority to all who lost it under the one-year seniority clause. In fact this principle is being recognized by other manufacturers.

Steel Scramble Continued

Local steel company offices are still besieged with customers clamoring for all classes of steel, despite the fact that fourth-quarter tonnage was practically sold out immediately following outbreak of war in Europe. Major producers had reaffirmed prices for the fourth quarter and did not expect the deluge of orders because so much tonnage was placed in advance during the cut-price days in May. Now salesmen are finding difficulty in locating a spot to slip in new orders. Older and less efficient steel making capacity takes time to get into production. So a real steel famine may exist before the end of the year.

The best explanation of the burning desire of customers to cover their present and future requirements is: (1) stocks were very low, and plants are striving to build them up know-

ing that prices must advance next quarter, (2) business turned up strongly in the summer and manufacturers are consuming more steel. No indication can be seen in a review of present orders that customers are taking material for other than purely domestic and peaceable products.

Willys to Triple Output

Willys-Overland is off to a flying start on its new model program, having made 4,000 cars in September as compared to 2,200 during the first month of the 1939 model season. Employment stands at 3,200 people, and it now has 1,500 dealers as compared to 1,000 a year ago.

In October, Willys will step up output to 4,500 (5,500 is peak capacity). With new dealers being added daily, it is in the cards for this firm to produce 15,000 vehicles during the last quarter, or approximately 200 per cent more than during the last 90 days of 1938 when only 5,300 were made. At that time the company did not have the strong management of J. W. Frazer, the good cash position it now enjoys, nor a product that was styled competitively with larger makes.

Flying Start—*Off to a flying start is Willys-Overland, with 4,000 cars manufactured in September and 4,500 scheduled for October. General sales manager M. J. Golden, right, congratulates president Joseph W. Frazier as one of the new 75-m.p.h. models rolls off the assembly line. Number of dealers has been increased 50 per cent, output 100 per cent, over the same period of last year*

War Increases Chances of CIO-AFL Peace; Higher Pay, Skilled Labor Shortage Seen

By FRANK RISING
Labor Editor, *American Machinist*

NEW YORK—Coming out of the nervous hysteria of the first month of war pressure, business management and labor leaders have shaped up three or four problems as paramount and now are getting to work on them. Policy lines are forming as follows:

1. In the matter of the AFL-CIO intramural battle: Business views, public sentiment, and government opinion all are overwhelmingly to the effect that the labor federations must drop their bickering, that the national need for unified action cannot be sacrificed even in part for the promotion of personal or political jealousies. Results will be apparent in the October conventions of the AFL (in Cincinnati, beginning Oct. 2) and of the CIO (in San Francisco, beginning Oct. 10). The rank-and-file pressure for an immediate truce and resumption of peace negotiations is coming up in 100 per cent proportions from both sides.

2. In the matter of war-time advisory boards: Labor is boiling mad at the trend shown in the initial effort along these lines, whereby a war board without any labor representation at all was set up. Many business men, too, are frank in saying that practical management must fight for a full share of responsibility on such boards and not be crowded out by financial control. On the labor front, *American Machinist* readers can look for tremendous pressure for immediate recognition of the right of labor to be fully represented at such council tables. But government spokesmen say that it is the AFL-CIO war which prevents action here, and that no one knows who represents labor any more.

3. In the matter of potential skilled-labor shortages: Nobody denies that such shortages will be readily apparent if a period of war-time production gets under way. Some machine tool makers feel the pinch already; the national average for hours worked is running around 41 or 42, which means that many shops are paying overtime. Labor leaders are reluctant to relax the depression restrictions on apprentice training, because there are still more machinists than there are full-time, long-term jobs. Employers aren't anxious to do anything to build a new reservoir of skilled labor "right now" because a rapid-training system might turn out men who are not quite good enough—consequently it might be better business to pay overtime for the men who were on the job, and not seek trainees.

Fear Labor Shortage

Taking an ever-growing interest in this problem of building a skilled-labor reservoir, the government is surveying the possibilities of assisting expert machinists in getting to the jobs. For example, if the Southern California aviation industry needs men which New England can spare, a means of providing train fare for the worker and his family and guaranteeing a sufficient job tenure could be worked out. The Canadian government already increases the flexibility and mobility of the labor supply in this way.

Before the potential shortage arrives, and even afterward, there are ways of avoiding undue blockades, and business management now is using some of them. One is the change to full-time production from three- or four-day weeks, another is the use of all the aids which technological advances can offer, if expansion beyond capacity becomes necessary. These natural steps to a great extent will allow the time lag necessary in getting new men trained for jobs.

Meanwhile, business on a hundred different fronts is preparing to meet labor demands for increased pay—in other words, for a share in anticipated profits. Worried about the possibility of drawing differentials out of proper alignment, and of establishing war-time scales which might be ruinous in a sudden drop-off of orders, many a business man is wondering if it might not be better to try to hold a "normal" scale of pay and offer extra-profit bonuses which could be more readily adjusted to changes in the production curve. Management may find that the good sense of such a suggestion, fully and fairly explained, can be sold to the intelligent labor leader—and that much future trouble can be avoided.

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

President disbands War Resources Board. Strong desire for peace on part of both Industry and Labor believed partly responsible for this decision.

WASHINGTON—Industry and labor are both on record against involvement in the European war and they are regarded as the white hopes of staying outside the ring. The tremendous power of this team against participation has already settled some of the dust hereabouts. Many think this strong peace combination encouraged President Roosevelt to disband the War Resources Board. They regard his crack at Assistant Secretary of War Louis Johnson (who wrote a blurb for a mobilization book) as a pacifier. Johnson's constant pressure for preparedness is looked upon by some peace makers as a menace. So they are pleased. Labor and Industry think they can prosper during the war if we stay out, and that they can avoid another 1931 afterward by supplying peace goods to the weary world. But they are a bit worried as to the President's intentions. They think maybe he threw out the Stettinius boys at behest of the Corcoran and Cohen boys. While business doesn't like Louis Johnson's war dance, it would nevertheless hate to see him dismissed so that War and Navy's ten-year job on the mobilization plan could be turned into a military New Deal. Business knows it can get fair treatment from the old guard military, but it wouldn't be sure about a pink tinted and streamlined war machine. It can only hope, in this dilemma, that the Executive, whoever he may be at the time of trouble, will forsake all others than the public interest.

Surprised at Roosevelt's sudden announcement that the War Resources Board will report and fall out, Washington wonders why. Did FDR ever intend WRB to be permanent? Is he liquidating it to minimize any war hysterics? Is he swinging away from business advisers and closer to brain trusters? You can answer from Enterprise, Oregon, as well as the experts can from here.

The Administration is deeply concerned what to do about labor if war threatens and is quiet as a mouse about it. Labor is scared stiff it will be regimented and shorn of its Wagner law privileges. It resented being omitted from the War Resources Board. It wants to measure its own cut of whatever prosperity may come, rather than let either government or business do it. Labor administration would be one of the toughest jobs in any mobilization of resources beyond what we have now.

Exit Andrews?

Wage-Hour Administrator Andrews seems on his way out; Lt. Col. Philip Fleming has been offered the job and may or may not take it. Andrews' order of a flat textile wage without differential for the South despite FDR's thoughtless blast favoring differentials had nothing to do with the case. Those are the facts; this is gossip: That John Lewis and Sidney Hillman got Roosevelt to fire Andrews for not cracking down harder on violations; or that FDR sacrificed Andrews for agreement by them to fall in line for the "emergency" and stop rowing with AFL; or that Sec. Perkins, who controlled Andrews when she was his boss in New York, took the fury of a woman scorned to the White House after her utter failure to control him here. Repeat: that's gossip. The town is mystified, knowing that the President is chicken-hearted about canning people. Andrews performed a miracle, coming near as he did to pleasing most labor and employers.

Defense Activity Continues

National Defense Advances: (1) War Department is sounding Congress on authorization for expansion, particularly for air power and tanks; action not likely this session unless it stays late in the year. (2) War Department is dishing out huge airplane orders under last session's appropriations. (3) National Advisory Committee for Aeronautics selects Sunnyvale, Calif., as site of new air experiment station, to cost $10,000,000. (4) Navy plans to operate some shipyards around the clock. (5) Revision of Army and Navy procurement procedure for more liberty under bidding system is expected next session. (6) Collection of strategic materials under the new $10,000,000 appropriation, plus executive restriction on exports, are under way. (7) The CAA pilot training program is under full throttle; airport expansion under subsidy will be asked next session. (8) Shifting and boosting of Army personnel are being pushed and next session will be asked for about $400,000,000 in addition to the usual half billion to raise land forces to one million. The Budget Bureau estimates that European fracus has already committed the U. S. to a 1939 cost of $112,000,000 for augmentation of Army, Navy and Marine corps.

Shies Away From Price Fixing

Government wants to avoid imposition of direct price control upon industry, but the Administration has a plan in its medicine kit in case of fever. It would not attempt to control price fluctuations around arbitrary or cost-of-production standards, but neither would it depend upon such vague legislation as the Lever Act of 1917 which forbade "excessive" prices without defining "excessive." An administrative agency would have discretionary power to control prices considering all factors that affect prices naturally—plus last war's experience. It would not control *all* prices—only those on goods vital to war. The National Defense Act of 1916, which enables the President to fix prices, is still on the books; it can be invoked "in time of war or when war is threatened." That "threatened" word is vague too, but chances are the White House would need new legislation for action in peace time—if you call *any* time peace time. Meanwhile, Roosevelt has tremendous power to "talk prices down."

MORE SHIPBUILDING

WASHINGTON — Look for the most feverish shipbuilding campaign the world has ever seen to develop in the very near future. Regardless of the arms embargo, which will be repealed, ships are vital to Britain and France. Supply lines for food, oil, steel, arms and munitions must be kept open, no matter how many ships the Germans may send to the bottom or frighten into hiding in neutral harbors.

No matter what restrictions may be written into the new neutrality law, ships can still be built in this country and sold—cash and carry—to the British. Shipbuilding will be profitable anyhow—there will be all sorts of buyers, as in the World War, seeking a big profit not only in the munitions trade but in carrying sugar, oil, and what have you.

As to the embargo, the isolationists are fighting a losing battle, despite the biggest volume of propaganda on their side which the Senate and House post offices have handled in years. The only changes so far have been toward the repeal side, which means that the letters and telegrams are discounted, not that the statesmen are unusually brave.

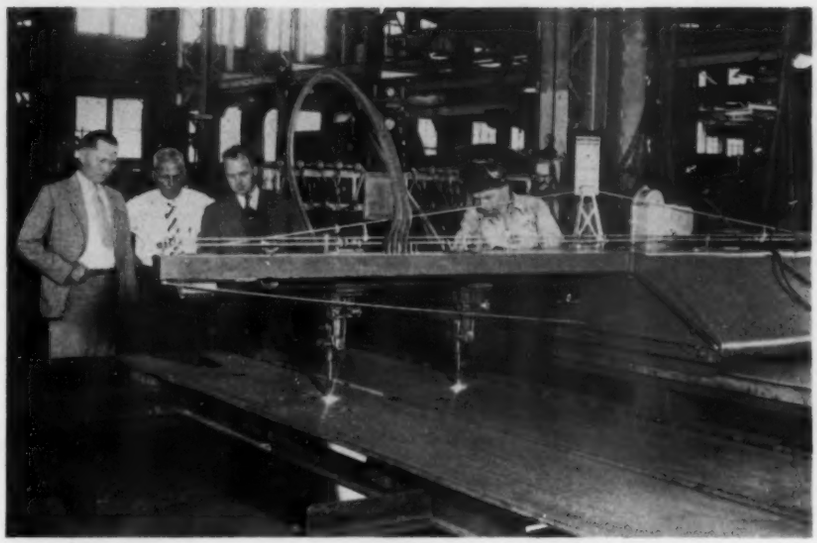
ASM, AWS TO PARTICIPATE IN METALS CONGRESS ACTIVITIES

CHICAGO—Over 140 papers discussing the knowledge of metals gained during the last year will be presented at the technical sessions of the National Metals Congress to be held in Chicago Oct. 23–27.

Annual meeting of the American Society for Metals will be held on the morning of Wednesday, Oct. 25, at which time the Campbell Memorial Lecture will be delivered by E. S. Davenport, U. S. Steel Corp., Kearney, N. J.

Outstanding among the society's scheduled events will be a series of educational lectures extending throughout the entire week. These will comprise talks on "The Functions of the Alloying Elements in Steel" by E. C. Bain, United States Steel Corp.; and discussions of "Visual Examination of Steels—Macroscopic Technique," by G. M. Enos, University of Cincinnati.

Papers to be presented at the technical sessions of the American Welding Society have been divided into several groups, those falling into the same classifications to be presented the same day. These classifications include government construction work, industrial research, production welding in light gage material, fundamental research, machinery construction, welding equipment construction, flame hardening and hard surfacing, resistance welding, welded piping, pressure vessels and boilers, cutting and welding in steel mills, welding in structural and ship work, railroad welding, and miscellaneous applications.



Cost Cutting—*Costs are cut and production doubled by using two torches in tandem on this cutting machine. Watching the operation are, from left, Harry C. Boardman, president American Welding Society; Eugene A. Balsley, A.W.S. Chicago section chairman; and L. S. McPhee, society vice-chairman*

MORE AIRPLANES FOR THE ARMY

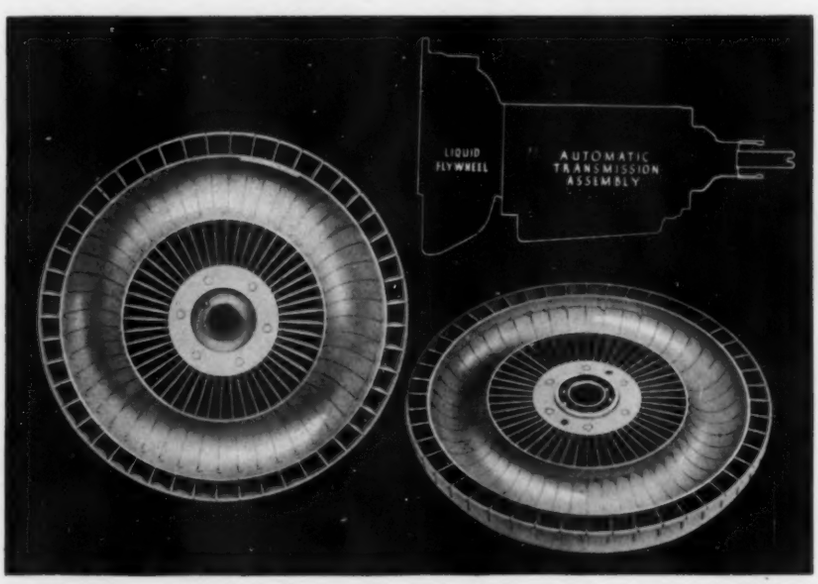
WASHINGTON — War Department has awarded Glenn L. Martin a $16,125,586 order for bombers. Other huge plane orders include North American Aviation $13,049,601 for trainers; Consolidated $8,613,674 for bombers; Boeing $8,102,892 for bombers; Lockheed $4,653,703 for pursuit ships; Vultee $3,029,036 for trainers; Stearman $2,843,405 for trainers; Stinson $1,853,451 for observation ships.

FULL-AUTOMATIC TRANSMISSION OFFERED ON 1940 OLDSMOBILES

DETROIT—Without use of a clutch, gears are shifted automatically through four forward speeds by the "Hydra-Matic" drive, an optional feature on the 1940 Oldsmobiles to be announced Oct. 11. New drive incorporates a fluid flywheel having a slip of ¼ per cent and an automatic transmission which is the outgrowth of its automatic safety transmission brought out two years ago. Drive is being made by the new $3,000,000 Detroit Transmission Div. of General Motors, and is $18 cheaper than last year's estimate for the automatic transmission only.

Under the steering wheel is a lever with four positions indicated on a quadrant for neutral, high, low and reverse. With the engine running, the lever is moved from neutral to high, the accelerator depressed, and the car moves forward smoothly, changing its gears through first, second and third, until at 23 m.p.h. it enters fourth, a direct drive with a rear axle ratio of 3.6 to 1. For quick acceleration, pressing the accelerator all the way down changes the gears from fourth to third, or "pick-up" gear, providing the equivalent of a rear axle ratio of 5.25 to 1. Low is used only in deep sand or mud or in climbing or descending an extremely steep hill.

The fluid coupling has two identical rotors resembling shallow steel basins, their concave surfaces divided by vanes. These are mounted with concave surfaces facing, 1-32 in. apart, one attached to the crankshaft, the other to the transmission. Both are inclosed in a steel housing filled with oil, under 30 lb. pressure.



Flexible as Steam—*Only an accelerator pedal, brake and steering wheel are required to control a 1940 Oldsmobile equipped with the optional "Hydra-Matic" drive. A fluid flywheel displaces the clutch, making a flexible connection between the engine crankshaft and the improved automatic transmission.*

NEIL CURRIE, JR.

MANLEY E. LORD

B. H. LAWRENCE

PERSONALS

MANLEY E. LORD has been appointed manager of the Fort Wayne works of the General Electric Co., Schenectady, N. Y. Mr. Lord succeeds NEIL CURRIE, JR., who is relinquishing his position to become assistant to the vice-president in charge of manufacturing.

CLARENCE AVILDSEN, chairman United Tool & Drill Corp., Chicago, Ill., has been appointed special advisor to secretary of commerce HARRY L. HOPKINS.

Rear Admiral S. M. ROBINSON, U.S.N., has been appointed chief of the Bureau of Engineering. Rear Admiral WILLIAM G. DUBOSE, (CC), U.S.N., has been detached from duty as chief of the Bureau of Construction and Repair and appointed director of the David W. Taylor Model Basin. He will be succeeded by Captain ALEXANDER H. VAN KEUREN (CC), U.S.N., who is stationed at the Philadelphia Navy Yard as industrial manager. Captain Van Keuren in turn will be relieved by Captain ALLAN J. CHANTRY (CC), U.S.N.

PHILIP G. JOHNSON, president Motor Truck Corp., Seattle, Wash., has been elected president of the Boeing Airplane Co. and the Boeing Aircraft Co., Seattle, Wash.

WILLIAM A. ROSS has been elected president of the Columbia Steel Co., Los Angeles, Calif., subsidiary of the United States Steel Corp. He succeeds AMBROSE N. DIEHL, who resigned recently on account of ill health after heading the company since 1932.

JOHN C. DABNEY, former manager of sales research and promotion, Harris-Seybold-Potter Co., Cleveland, Ohio, has been named sales manager of the company's Seybold division at Dayton, Ohio.

B. H. LAWRENCE, formerly chief engineer, has been elected vice-president in charge of Engineering, United States Steel Corp. of Delaware, and a member of its executive committee and board of directors. With the exception of three years, Mr. Lawrence has been connected with United States Steel subsidiaries during his entire engineering career. He has served in executive engineering capacities in the Chicago, Ill., Worcester, Mass., and Cleveland, Ohio, districts; and has been chief engineer of the United States Steel Corp. of Delaware since January 1, 1938.

JOHN S. BARTEK, former chief engineer, Modern Tool Works, Rochester, N. Y., has joined the engineering staff of the Pioneer Engineering & Mfg. Co., Detroit, Mich.

H. R. LASCH, manager Machine Tools, Ltd., Johannesburg, South Africa, is visiting the United States to secure additional lines of machine tools.

AVERY C. ADAMS, vice-president and assistant general manager of sales Inland Steel Co., has been elected vice-president in charge of sales and a member of the executive committee and board of directors of the United States Steel Corp. of Delaware. He succeeds C. V. MCKAIG, who becomes assistant to the president and who will continue as a member of the executive committee and board of directors.

CHARLES A. CRIQUI, SR., founder and for 33 years president Sterling Engine Co., Buffalo, N. Y., has resigned but will continue to be actively engaged in the company's affairs as chairman of the board of directors. The company will henceforth be headed by SPENCER H. LOGAN as president and ADDISON VARS as executive vice-president.

JOHN P. HOELZEL, vice-president Pittsburgh Screw & Bolt Corp., Pittsburgh, Pa., has been elected president. He succeeds CHARLES R. FERGUSON, who has been named chairman of the board. Mr. Ferguson in turn succeeds JOHN F. MILLER, resigned, who will continue as director and vice-chairman of the board.

JOHN C. GEARHARDT has been named manager of Tool Steel sales for the Detroit district, Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

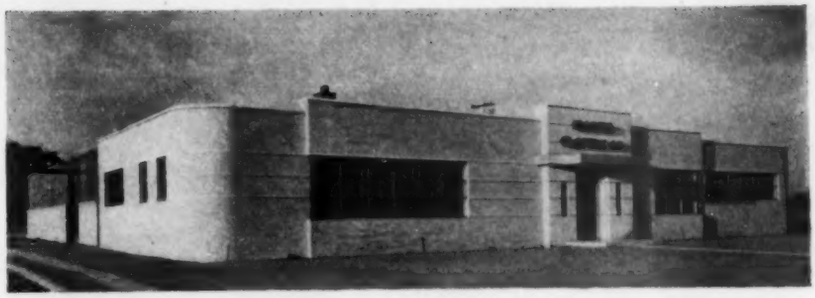
FRANCIS A. CALDEN, formerly with the E. W. Bliss Co., has joined the hydraulic press sales staff of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

U. S. Government Contracts Awarded to Metal-Working Firms

(Additional awards on page 830c)

Contractor	Gov't Agency	Commodity	Amount
American Tool Works Co., Cincinnati, Ohio	War, Ordnance	Engine lathe	$10,807
Monarch Machine Tool Co., Sidney, Ohio	War, Ordnance	Engine lathes	17,421
Rockford Machine Tool Co., Rockford, Ill.	Navy, S. & A.	Shapers	49,739
Reed-Prentice Corp., Worcester, Mass.	Navy, S. & A.	Engine lathes	22,580
Warner & Swasey Co., Cleveland, Ohio	War, Ordnance	Turret lathes	129,637
Morris Machine Tool Co., Cincinnati, Ohio	War, Ordnance	Radial drills	32,250
E. W. Bliss Co., Brooklyn, N. Y.	War, Ordnance	Vertical presses	14,925
Kearney & Trecker Corp., Milwaukee, Wis.	War; Navy	Milling machines	24,598
Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, Ohio	War, Ordnance	Milling machines	28,918
Chas. F. Elmes Engineering Works, Chicago, Ill.	War, Ordnance	Bending brake	14,500
Universal Boring Machine Co., Hudson, Mass.	War, Ordnance	Boring mills	35,650
Bay City Shovels, Inc., Bay City, Mich.	Farm Sec.; Proc.	Power shovels	33,150
Harnischfeger Corp., Milwaukee, Wis.	Farm Sec.	Power shovels	23,102
General Excavator Co., Marion, Ohio	Procurement	Power shovels	31,736
McKiernan-Terry Corp., Harrison, N. J.	Navy, S. & A.	Airplane crane	126,860
Alliance Machine Co., Alliance, Ohio	T.V.A.	Crane	83,789
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.	War, Ordnance	Cartridge loading machine	37,125
Research Corp., New York, N. Y.	T.V.A.	Precipitator equipment	57,770
Habirshaw Cable & Wire Div., Phelps Dodge Copper Products Corp., New York, N. Y.	T.V.A.	Wire; Cable	31,932
Aluminum Co. of America, Pittsburgh, Pa.	T.V.A.	Electrical conductor	32,436
Roller-Smith Co., Bethlehem, Pa.	War, Engineer	Switchboards	39,549
Wright Aeronautical Corp., Paterson, N. J.	Navy, S. & A.	Engines	375,009
Curtiss-Wright Corp., Curtiss Propeller Div., Clifton, N. J.	Navy, S. & A.	Propeller assemblies	275,310
Caterpillar Tractor Co., Peoria, Ill.	Farm Sec.; Proc.; Int.	Tractors	263,371
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	Procurement	Tractors	183,578
Thomas Truck & Caster Co., Keokuk, Iowa	Post Office	Platform trucks	24,680
Hanson-Whitney Machine Co., Hartford, Conn.	War, Air Corps	Thread gages	18,008

BUSINESS ITEMS



Modernism—*Martin Electric Co., manufacturer of various types of electric welding equipment, has moved into its new plant located on Outer Drive, Detroit*

Cutler-Hammer, Inc., has expanded its Denver, Colo., office to provide full service on an extensive line of motor controls, safety switches, service controls, magnetic clutches, etc.

Taylor Winfield Corp., Warren, Ohio, has opened an office in Worcester, Mass., headed by V. WAYNE GREEN.

Sivyer Steel Casting Co., Milwaukee, Wis., is planning the erection of a new building to house its core and stainless steel operations. It will be constructed at a cost of $50,000 and be the first unit in an extensive building program.

Ladish Drop Forge Co., Cudahy, Wis., is erecting a 185x195-ft. addition to its plant at a cost of more than $70,000.

North American Aviation, Inc., Los Angeles, Calif., is planning additions to its factory to cost between $500,000 and $1,000,000.

Northrop Aircraft, Inc., has awarded a contract for the construction of its $500,000 plant at Hawthorne, Calif.

American Bantam Car Co., Butler, Pa., has authorized a $1,000,000 bond issue for expansion purposes.

Harvey Machine Co., Los Angeles, Calif., is erecting a $10,000 addition to its plant.

Boston Wire Sticher Co., Boston, Mass., has purchased the Bay Mill property, East Greenwich, R. I., and plans are under way to modernize the plant with a view to expansion in the manufacture of staples and stapling machines. As soon as possible some departments of the company will be transferred to the newly acquired plant.

Fray-Mershon, Inc., Glendale, Calif., has announced that all advertising and merchandising of "All Angle" full universal milling machines and "All Angle" vises will henceforth be done under the name of Fray Machine & Tool Co., Glendale, Calif. Fray-Mershon, Inc., will hereafter concentrate its activity on the manufacture and distribution of various sporting goods products and firearm accessories.

Burdett Oxygen Co., Cleveland, Ohio, has been appointed Ohio distributor for the line of a.c. electric welders manufactured by the Hampton Electric Tool Co., Pittsburgh, Pa.

L. A. Young Spring & Wire Corp., Detroit, Mich., is planning to transfer additional activities to its Chicago plant. Construction is under way on a one-story, 33,000-sq.ft. addition to its plant to be used in the manufacture of parts for automobile seat cushion springs previously made in Detroit.

A. Milne & Co., New York, N. Y., has been appointed United States correspondent for the English Steel Corp., Ltd., Vickers Works, Sheffield, England.

Union Carbide & Carbon Corp., New York, N. Y., will acquire all the assets of the Bakelite Corp., New York manufacturers of "Bakelite" plastics. Agreement will become effective upon ratification of the plan by Bakelite stockholders.

Meehanite Metal Corp., Pittsburgh, Pa., has granted licenses to manufacture "Meehanite" to the Vancouver Engineering Works, Ltd., Vancouver B. C., and to the Washington Machinery & Supply Co., Spokane, Wash.

Sundstrand Machine Tool Co., Rockford, Ill., has appointed Golden & McCoy, 270 Rockefeller Bldg., Cleveland, Ohio, as its Cleveland distributor. The line was formerly handled by the Brown Tool Co., 10465 Carnegie Ave., Cleveland.

Allegheny Ludlum Steel Corp. has completed a new warehouse and office in Ferndale, Mich. Offices are housed in a two-story, 36x84-ft. building, while the warehouse comprises a 200x84-ft. structure. Extensive line of tool steels, stainless steels, "Nitralloy," heat-resisting steels and "Ludlite" will be carried. Tool steel sales for the Detroit district will be in charge of JOHN C. GEARHARDT.

Northrop Aircraft, Inc., is planning a military airplane factory and test field on a recently purchased 72½-acre site in Hawthorne, Calif., a suburb of Los Angeles.

Moline Tool Co., Moline, Ill., has made final arrangements to take over the manufacture and sale of special high production drilling, boring and tapping machines heretofore manufactured by the Rockford Drilling Machine Div., Borg-Warner Corp., Rockford, Ill.

Chain Belt Co., Milwaukee, Wis., manufacturer of sprocket chain, conveyors and construction machinery, has acquired the business and net assets of the Baldwin-Duckworth Chain Corp., Springfield, Mass. Plan of acquisition, which is in effect a merger of the two companies, will be effected by the issuance to Baldwin-Duckworth stockholders of some 140,000 shares of the no-par common stock of the Chain Belt Co. The newly acquired plants at Springfield and Worcester, Mass., will retain their identity and be known as the Baldwin-Duckworth Div. of the Chain Belt Co. GEORGE H. EMPSALL, FRANK J. WESCHLER and GEORGE D. GILBERT, all directors of the former Baldwin-Duckworth Chain Corp., have been elected directors of Chain Belt Co. In addition, Mr. Empsall and Mr. Weschler have been elected vice-presidents of the company. Mr. Weschler has been appointed general manager and Mr. Gilbert general sales manager of the Baldwin-Duckworth Div.

Aluminum Co. of America, Pittsburgh, Pa., is building a 15,000-sq.ft. addition to its aluminum research laboratories at New Kensington, Pa. Additions will provide increased laboratory facilities, more shop space and an extension to the main building.

Industrial Colloids, Inc., 1316 W. Cermak Rd., Chicago, Ill., has begun manufacture of a line of industrial colloids compounded for various mechanical purposes. Included are high-temperature lubricants, high-temperature joint compounds, plastic gaskets and packing compounds.

The Strippit Corp., 1559 Niagara St., Buffalo, N. Y., has moved to larger quarters at 1200 Niagara St.

Le Roi Co., West Allis, Wis., maker of gas engines, is planning plant additions to cost approximately $10,000.

Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn., is acquiring the property of the American

Ring Co. Buildings will be razed and the property utilized for storage purposes.

T. B. Wood's Sons Co., Chambersburg, Pa., has appointed the following as distributors for its line of power transmission equipment: M. L. Erlenmeyer, Elmira, N. Y.; Boyer-Campbell Co., Detroit, Mich.; and Berger Bros. Electric Motors, Inc., Rochester, N. Y.

OBITUARIES

WILLIAM T. ADAMS, 76, president of the Adams Mfg. Co., Reading, Pa., and of the Berks Foundry & Mfg. Co., West Hamburg, Pa., died recently in a Reading hospital following a six months' illness.

EDWIN HEWITT BROWN, 60, former vice-president and treasurer General Aluminum & Brass Mfg. Co. and a director of the Bohn Aluminum & Brass Corp., died recently.

EDWARD J. CONNOLLY, 48, president Hayes Body Corp., Grand Rapids, Mich., died Aug. 20 of a heart attack.

PHILIP W. DIETLY, 79, president Erie Machine Shops, Erie, Pa., died Sept. 17 following a brief illness. He had been identified with the organization for more than 50 years.

EUGENE NOBLE FOSS, 81, former governor of Massachusetts and well known in the machine tool industry, died Sept. 9 at his home in Jamaica Plain, Mass. He had been salesman, treasurer, and finally president of the B. F. Sturtevant Co., Hyde Park, Mass.

LORAN J. HARVEY, for 39 years general foreman of the West Lynn, Mass., plant of the General Electric Co., died Aug. 24.

ROBERT A. MACKIE, 81, since 1907 chairman Bradford Supply Co., Bradford, Pa., oil field equipment concern, died recently.

CHARLES M. SCHWAB

CHARLES M. SCHWAB, chairman of the board Bethlehem Steel Corp., died Sept. 18 at his home in New York City. He was 77 years of age.

Born in Williamsburg, Pa., in 1862, Mr. Schwab received his formal education at St. Francis College at Loretto, Pa., and landed his first job in the Edgar Thomson Steel Works at Braddock, Pa. Two years later he was appointed chief engineer and assistant to the general manager. Promotion succeeded promotion, and in 1901 he was named first president of the United States Steel Corp. at the age of 39. In 1903 he retired, and the following year organized the Bethlehem Steel Corp., with himself as chairman and president.

MARTIN J. SCHABACKER, 75, vice-president Bury Compressor Co., Erie, Pa., died Sept. 8 at his home in that city following a brief illness.

WADEMAR P. SCHOENOFF, 39, electrical engineer in charge of maintenance at the Beloit Iron Works, Beloit, Wis., died Sept. 12.

CHRISTOPHER C. SMITH, 78, founder of the Chris-Craft Corp., Algonac, Mich., died Sept. 9.

GEORGE A. TABER, 74, for 40 years head of the National Foundry Supply Co., Boston, Mass., died Aug. 15 at his home in Quincy.

Plating Plant—*To provide increased facilities for plating and finishing parts for the automotive, refrigeration, plumbing and other industries, the Gerity-Adrian Mfg. Corp. is constructing this 300 x 100-ft. building in Adrian, Mich. Designed by Albert Kahn, Inc., Detroit, it will be finished in November*

MEETINGS

AMERICAN GAS ASSOCIATION. Twenty-first annual convention, Hotel Pennsylvania, New York, N. Y., Oct. 9–12.

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Twenty-second semi-annual meeting, Whitcomb Sulphur Springs, St. Joseph, Mich., Oct. 16–18.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Annual meeting, Blackstone Hotel, Chicago, Ill., Oct. 23–28.

AMERICAN SOCIETY FOR METALS. Twenty-first annual meeting, Palmer House, Chicago, Ill., Oct. 23–28.

AMERICAN SOCIETY OF TOOL ENGINEERS. Semi-annual meeting, Hotel Statler, Cleveland, Ohio, Oct. 6 and 7.

AMERICAN WELDING SOCIETY, Twentieth annual meeting, Stevens Hotel, Chicago, Ill., Oct. 23–28.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION. Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Oct. 6 and 7.

INDUSTRIAL MANAGEMENT SOCIETY. National time and motion study clinic, Medinah Club, Chicago, Ill., Nov. 3 and 4.

NATIONAL AUTOMOBILE SHOW. Fortieth national automobile show, Grand Central Palace, New York, N. Y., Oct. 15–22.

NATIONAL METAL EXPOSITION, International Amphitheater, Chicago, Ill., Oct. 23–28.

NATIONAL SAFETY COUNCIL. Twenty-eighth national safety congress, Atlantic City, N. J., Oct. 16–20.

PACKAGING INSTITUTE. First annual meeting, Edgewater Beach Hotel, Chicago, Ill., Oct. 12–13.

PORCELAIN ENAMEL INSTITUTE. Fourth annual forum, Ohio State University, Columbus, Ohio, Oct. 18–20.

SOCIETY OF AUTOMOTIVE ENGINEERS. National aircraft production meeting, Hotel Biltmore, Los Angeles, Calif., Oct. 5–7. Annual dinner, Hotel Pennsylvania, New York, N. Y., Oct. 16. National transportation meeting, Hotel Coronado, St. Louis, Mo., Oct. 26 and 27.

WIRE ASSOCIATION. Annual meeting, Congress Hotel, Chicago, Ill., Oct. 23–28.

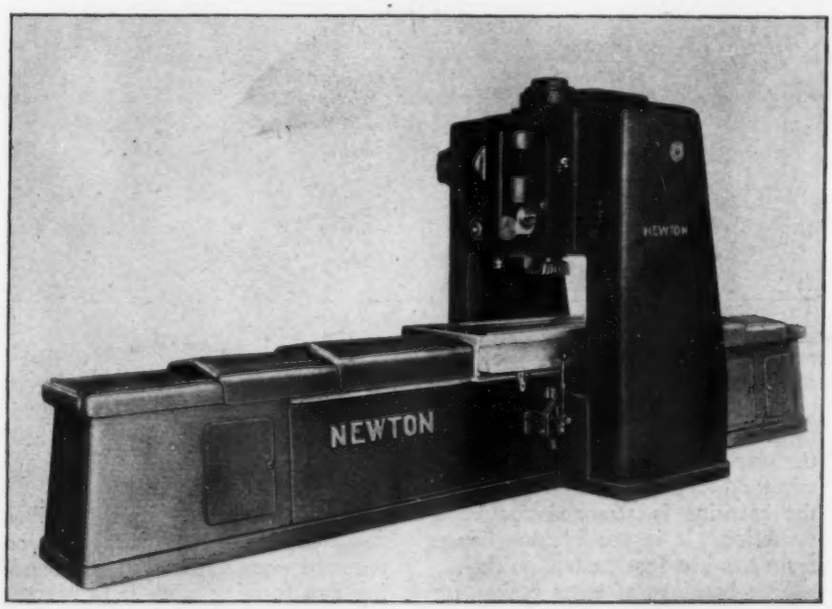
SHOP EQUIPMENT NEWS

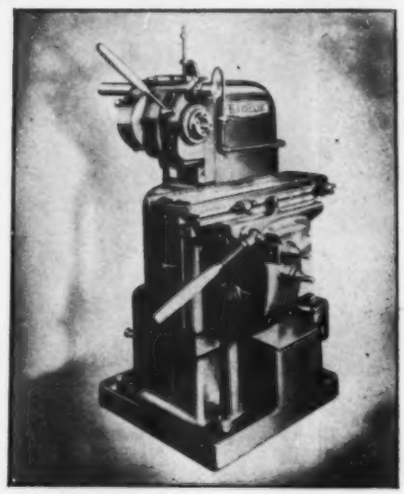
Newton Straight-Line "Mill-N-Shaver" Finishes at Rapid-Traverse Speed

Smooth and accurate surfaces are produced on the Newton straight-line type "Mill-N-Shaver" developed by Consolidated Machine Tool Corp., Rochester, N. Y. As compared with rough and finish milling, it is claimed that the finish obtained on these machines approaches the surface which might be obtained by grinding. High production is obtained because the finishing operation is accomplished during normal rapid traverse. In operation, this machine rough mills and then shaves on the rapid traverse return stroke. The cycle of operation is automatic from manual start to automatic stop. Cutter spindles are mounted on anti-friction bearings and are driven by individual motors. The machine has hydraulic feed and traverse to the table.

The "Mill-N-Shaver" may be arranged with one or more unit milling heads and the same number, or less, of shaving heads depending on the requirements of the work. The heads may be arranged horizontally or vertically, or placed at any angle to suit the surface to be finished. The shaving head is a heavy tool block in which is mounted one or more tungsten carbide blades. This head is mounted on a ram with micrometer adjustment provided for setting the depth of cut. The ram is arranged to automatically draw back, out of the way, while the work is rough milled and resumes its cutting position just before the return rapid traverse takes place.

Operation of the machine is as follows: normally, the table is in a position opposite that shown. The work is loaded and clamped in a fixture and the cycle is started manually. Automatically, the shaving head is drawn back to clear the work, the table advances in rapid traverse and drops into feed as the work approaches the rough milling cutter. At the end of the rough milling cut, the shaving head advances to the cutting position and the table returns in rapid traverse to the loading position. The principle of combined milling and shaving can be applied to various types of Newton milling machines, including the vertical continuous millers.



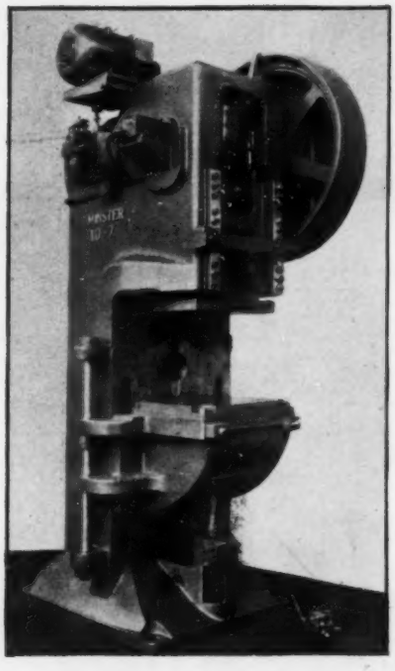


Van Norman Hand Mill Has 26x6 in. Table

Suitable for milling many small jobs in all production departments, the new hand mill offered by the Van Norman Machine Tool Co., 160 Wilbraham Ave., Springfield, Mass., has been built to insure maximum rigidity for taking heavy cuts. Six spindle speeds, ranging from 160 to 1,100 r.p.m., can readily be selected. Rack-and-pinion table feed is hand-controlled from either front or back, and table stops have micrometer adjustments. Table work surface measures 26x6 in. Vertical cutter head movement has a new positive control, and equalized belt tension on heavy-duty cutter spindle is maintained regardless of cutterhead position.

Horning and Wiring Press Has Gap Press Features

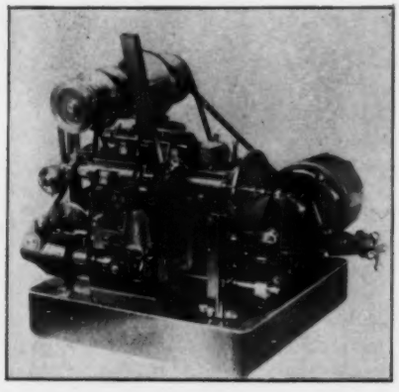
Capacity and many advantages of a gap press are achieved with the use of an adjustable swinging table on the 71-ton No. 10-7 press built by the Minster Machine Co., 52 W. 5th St., Minster, Ohio, and recently installed in a Detroit automobile plant. Press is equipped with an electrically-controlled, air-operated combination friction clutch and brake. Frame is of heavy cast semi-steel construction,



with an opening to accommodate a horn shank 7 in. in diameter. The Series 10 is built in eight sizes, ranging in capacity from 12 to 88 tons. Sizes No. 10-6 and smaller have as standard equipment the Minster "Multi-Engagement" spline clutch with the clutch wheel mounted on tapered roller bearings.

Waltham Gear Cutter Has Motor Drive

The improved 1½-in. pinion and gear cutting machine for cutting small diameter, fine pitch pinions offered by Waltham Machine Works, Waltham, Mass., is fitted with an individual motor drive. Previous machines have been furnished with overhead countershaft drive. A two-step cone pulley is used on the motor to give two speeds to the driving shaft. This shaft is connected by means of V-belts to the several units of the machine. One drives the cutter spindle by means of two-step cone pulleys; another drives the cam shaft for working the workslide, the indexing mechanism and the lifting of the cutter spindle from the work while the indexing is taking place during the return stroke of the workslide. A third pulley is belted to an oil pump and the fourth to a magazine operating shaft which is normally idle, but which makes one revolution after the cutting operations are completed. This machine is designed for use on a bench and requires a space of 20x22½ in. It weighs approximately 300 lb.



Bliss All-Steel Press Brakes Have Pushbutton-Controlled Clutch

Operation of the all-steel press brake announced by the E. W. Bliss Co., 53rd St. and 2nd Ave., Brooklyn, N. Y., is controlled through the action of an improved hydraulic clutch with pushbutton control for inching and stopping at any point of the stroke. The clutch also can be controlled by means of a treadle arrangement which can be tilted up out of the way so that it is not possible to trip the brake with the treadle while the machine is arranged for hand operation. It is possible to change from hand to foot control quickly.

Side housings of these brakes are made from cast steel proportioned to provide utmost rigidity. Slide and bed are made from rolled steel plate. Through the use of a gear reduction unit, speed can be changed from 10 to 20 strokes per minute, according to operating conditions. Stub shafts driving the connections are full eccentric, with the main, eccentric and intermediate bearings bronze bushed. The drive shaft runs in Timken roller bearings.

Slide is equipped with a ram shoe for large area dies. This shoe can be removed when standard narrow bending and forming work is to be per-

formed. A reversible motor adjusts the slide over a distance of 8 in. A ratchet adjustment is furnished for final hand adjustment of the slide. An over-load protection feature also is incorporated in this brake. This unit stops the machine if it should be subjected to an unusually heavy load which might damage it.

The brake shown has a capacity for bending ½ x 144 in. mild steel and has an 8 in. slide stroke. The machine is double geared and weighs approximately 110,000 lb. The slide measures 14 in. front to back and the bed measures 16 in. front to back. Distance from bed to slide, with stroke down and adjustment up, is 14 in. Height from floor to top of bed is 32 in.

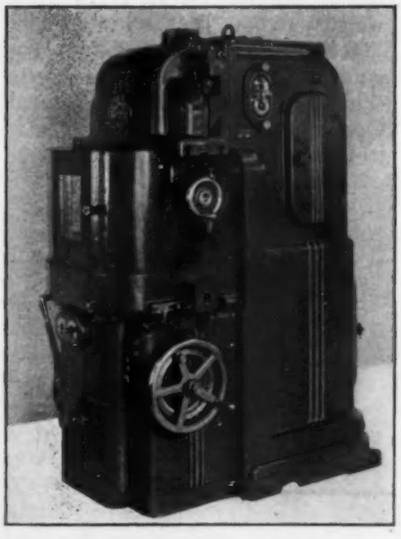
Michigan Finisher Shaves Wide Gears

Gears up to 5 in. in width, as well as splines on long shafts, can be crossed-axis shaved without requiring wide cutters in the No. 860-A gear finisher offered by Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. A companion machine to the recently improved No. 860 rotary cross-axis gear finisher (*AM*—Vol. 83, page 535), this machine incorporates a reciprocating transverse work head travel. For wide gears and spline shafts, the standard fore-and-aft table feed is locked out and a combination of reciprocating work head travel and vertical table feed is cut in.

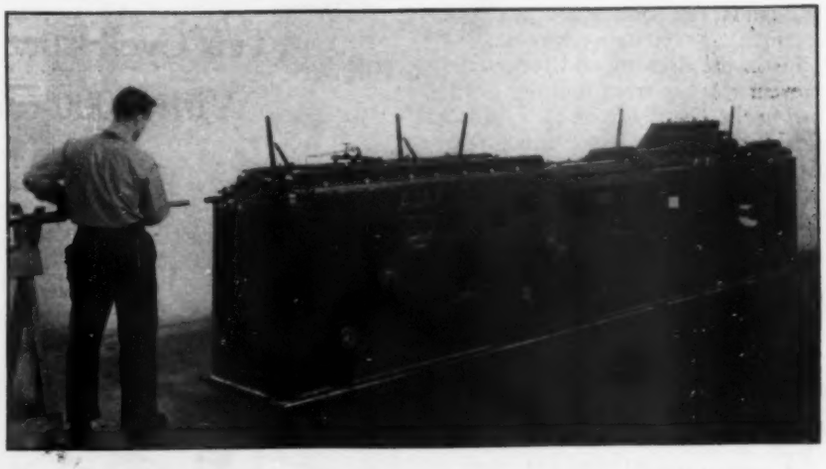
A selector switch permits ready change from the underpass method of finishing gears of more conventional size to the transverse feed method. When the latter is used, the cutter carrying table is locked in a central position and feed becomes vertical, by automatically raising the knee of the machine a fixed amount for each stroke of the reciprocating head. A counter with a dial indicator permits selection of the number of strokes for finishing the gear, while the amount of feed per stroke is controlled by setting an electric timer graduated in ten thousandths. A separate electric motor drive is provided for the feed. In series with this motor is a plugging timer to provide quick stopping of the feed motor, assuring accuracy of the amount of feed per stroke.

Operation of the feed is through "cone-drive" area contact worm gearing, as is the drive to the head for transverse reciprocation. Use of this gearing is said to provide increased smoothness of operation, resulting in finer finish and longer tool life. Number of oscillations of the head is controlled by change gears, while a limit switch with trips on either side, controls the length of the transverse stroke. A hand lever on the front of the machine permits rapid lowering of the knee for reloading and raising back to the automatic feed position.

When gears of conventional width are being finished, operation of the machine is identical with that of the No. 860 finisher, using a constant table height and allowing the table carrying the cutter to feed toward the rear of the machine, pause, and return, while the cutter is rotating in mesh with the work being finished. The No. 860-A finisher is available in three sizes for finishing gears up to 8, 12 and 16 in. in diameter. Maximum distance between work carrying live centers is 18½ in., but by means of an offset special headstock, this may be increased to 25½ in.



Ajax Drawing and Straightening Machine Produces Straight Cold Drawn Bars

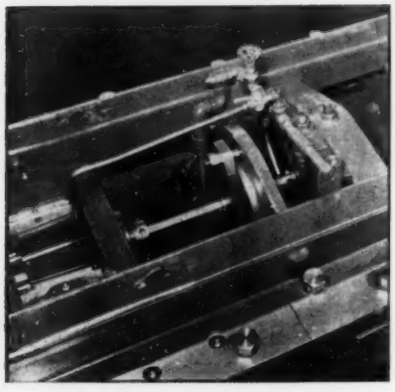


Pointing or chamfering the ends of bars to be used in screw machines is not necessary when they have been drawn and straightened in this continuous machine developed by Ajax

In one pass through the continuous cold drawing and straightening machine, cold drawn bars are produced accurately to size and commercially straight, ready for use in automatic screw machines and for other applications. Developed by the Ajax Mfg. Co., Chardon Road, Cleveland, Ohio, this unit is said to be easy to operate.

The operator starts a hot rolled, pickled and limed bar, or a hot rolled, blast-cleaned bar into the inching slide. This slide grips and starts the bar through the drawing die, eliminating any pointing operation. After passing through the die, the bar is gripped by the first drawing slide grips and, after advancing, passes into a second set of drawing slide grips. After this the bar is pulled at a uniform speed through the drawing die by hand-over-hand operation of the two drawing slides. As one slide pulls the bar, the other returns, and the pulling strokes overlap to keep the bar always in motion.

The bar then is pushed through a horizontal straightener in the freshly drawn condition, before any appreciable age hardening takes place. Very



The drawing die is secured in a rigid mounting which holds it in alignment in the die box

little overbending is required in the straightening rolls, because the bar is drawn in a straight line and is held by the drawing grips, which tend to keep it straight. From the straightening rolls, the bar passes through the feed slide and is pushed through the vertical straightener. Following this, the bar is gripped by a feed slide and moved out of the machine onto a run-out table.

Rounds and shapes are produced commercially straight because the grips in the drawing and feed slides prevent the bar from turning, eliminating the possibility of a round bar rotating enough to snake through the straightening rollers and so escape overbending. All straightening rollers are readily adjustable, making it possible to use rollers which have been redressed several times and still maintain the center line of the bar in alignment with the center line of the machine. Rollers are mounted on antifriction bearings and may be changed quickly.

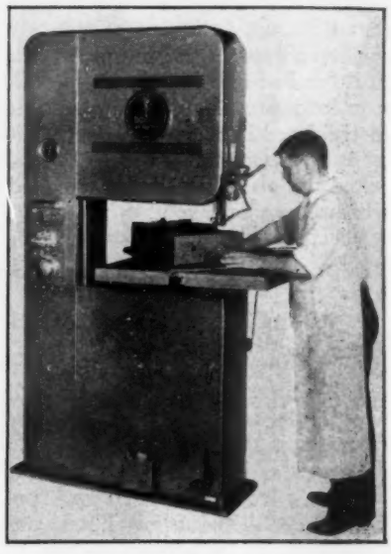
Continental "Doall 26" Has 30x30 in. Work Table

The "Doall 26" contour sawing and band filing machine offered by Continental Machines, Inc., 1301 Washington Ave. S., Minneapolis, Minn., is of arc-welded steel construction and has a large 30x30-in. work table. This machine can employ precision bandsaws of any width up to and including 1 in., whereas previous models accommodated saws up to ½ in. wide. The machine also can be used with a ½-in. wide file band in addition to ⅜- and ¼-in. bands.

A new automatic power work feed is one of the features of this machine. This feed exerts pressure into the saw throughout the contour. Any curve can be cut by handwheel control; no hand pressure is required for any type of cut. The machine table can be inclined in any direction, forward, rearward or sideways as much as 45 deg. Inclination of the table is accomplished by means of a hand screw to facilitate quick and accurate setting to any angle.

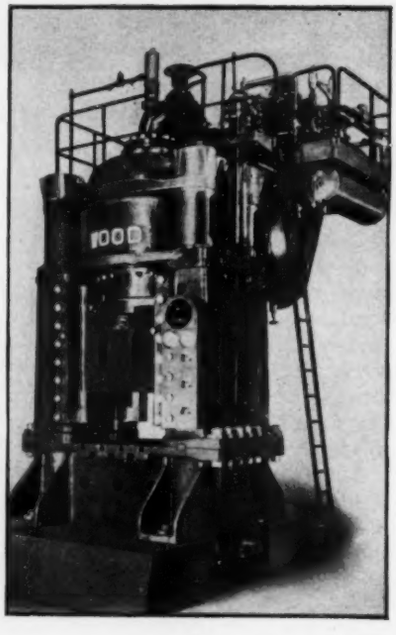
Another feature is a frictionless cutting attachment which permits easy machining of heavy work. The machine weighs more than 2,000 lb. and is driven by a 1½-hp. motor through a "Speedmaster" molded variable drive and through a silent transmission. This transmission contains eight helical gears which run in oil. A speed range from 50 to 1,500 lineal ft. per min. is provided. The speed is indicated on a tachometer dial. A job selector dial indicates the correct speed and type of saw or file to use for 48 different materials.

Specifications: distance from table to floor, 44 in.; wheel diameter, 26 in.; upper wheel adjustment, 10 in.; length of saws, 173 in.; length of file bands, 165 in.; depth of throat, 26 in.; maximum work thickness, 10 in.; height of machine, 85 in.; floor area required, 45 x 30 in.; standard motor, 1½ hp.; net weight, 2,000 lb. An automatic electric butt welder and a saw weld grinder both are mounted on one side of the machine column.



Ten Cycles per Minute Possible With 2,000-ton Forging Press

Ten complete operating cycles per minute are possible with the high-speed 2,000-ton forging press marketed by the R. D. Wood Co. and built by the Florence Pipe Foundry & Machine Co., Florence, N. J. Power unit consists of a radial piston pump having a capacity of 83 gal. of oil per min. at 2,500 lb. pressure, operated by a 125-hp. motor. Operation during the working cycle is automatic, the ram returning to open position and remaining for the period determined by the operating cycle before again descending.



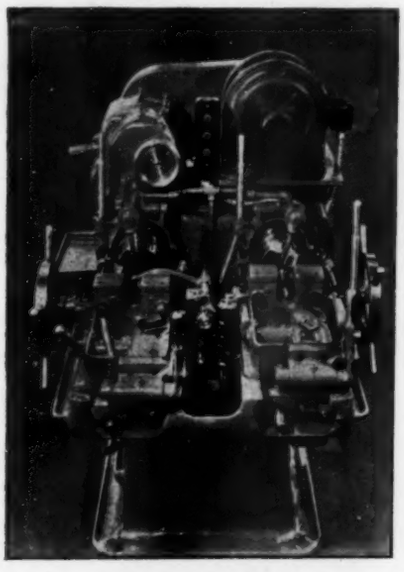
Pressures exerted upon the work may be regulated and set at any point from zero to 2,000 tons. Ram is 45 in. in diameter, 4 ft. 6 in. long, weighs 16,000 lb., and is cast in "Meehanite" metal. The four ram guide plates, one on each side of the column, are of the same material. Operation is entirely automatic, controlled by a pushbutton panel.

Double Head Machine Points, Turns and Faces

The ⅞-in. double head machine shown has been equipped by Landis Machine Co., Waynesboro, Pa., for a combination pointing, beveling, turning and facing operation. The machine is the standard Landis ⅞-in. double head threading machine equipped with leadscrews and with ⅞-in. "LANCO" hardened and ground heads. To this

standard machine have been added several fixtures which make it possible to handle this turning operation economically.

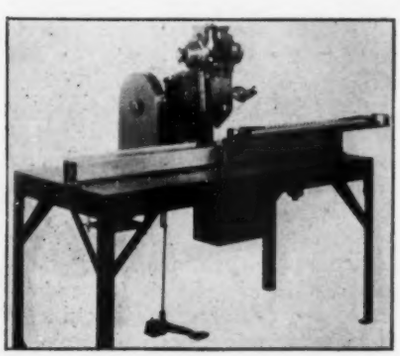
The special fixtures include milling cutters, which replace the usual chasers, a spring actuated tool holder to carry the pointing and beveling tool, and an automatic work stop for positioning the work in the vises.



Special milling cutters can be used for reducing the body diameters of long bolts, or cutters for a combination of turning and shoulder facing operation can be substituted. The pointing and beveling tools are carried in a holder which extends entirely through the spindle.

Multiple Rivet Setter Employs Movable Anvil

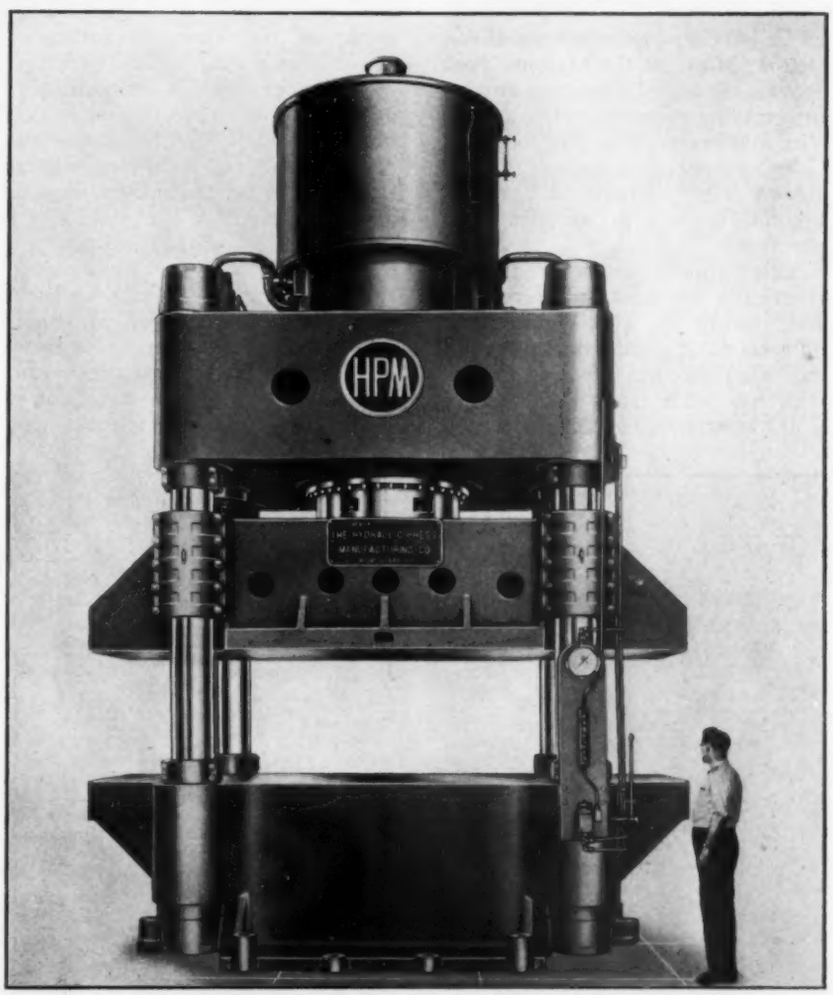
A multiple rivet setter employing a movable anvil which is actuated by a solenoid has been developed by the Chicago Rivet & Machine Co., 1832 S. 54th St., Chicago, Ill. Design of this unit permits the employment of a special indexing fixture, making the application of multiple setting to line assembly of small parts practicable. Pressure of the operating pedal causes the solenoid to actuate a toggle movement, raising the anvil into clinching position. When clinching is completed, the driver automatically raises and disconnects electrical contact with the solenoid. This causes the anvil to drop, permitting movement of the assembly fixture to the next indexing position. This unit is adaptable for clinching tubular rivets as well as eyelets.



"Fastraverse" 2,000-Ton Hydraulic Press Designed for Forming Airplane Parts

Designed primarily for the fabrication of duralumin airplane parts, this self-contained hydraulic press built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has a pressure capacity of 2,000 tons. Pressing surfaces at the sides are 92 x 72 in. and at the ends with extensions 60 x 180 in., making it possible to form or blank several different parts at one time. With the application of the Guerin process, developed and patented by the Douglas Aircraft Co., this press has become an increasingly popular size for use in the aircraft industry.

The Guerin Process consists fundamentally of using a block of rubber in the press platen instead of the customary die. This rubber is a high grade compound for resisting cutting and abrasion, and has high elongation properties. Inexpensive lower dies are made from steel, zinc or wood. Sheets of duralumin are placed over the dies which are mounted on a bolster plate of the same size as the block of rubber in the press platen. This bolster plate is fastened directly to the flat surface of the closed-top pedestal-type bed. Press platen then rapidly closes



to the work, and the rubber pad fastened in the press platen engages each die and flows in such a manner as to conform to the die contours, thereby producing parts identical in shape to the various dies. In the case of blanking operations, the pad sets up tension between the pressing block surface and the periphery of the die on the sheets to be cut, thus causing the metal to part at the cutting edge of the dies. From 2 to 35 complicated parts are formed at one pressing, or as many as 65 blanks are cut in one operation. At least 1,000 different parts now are handled in this manner.

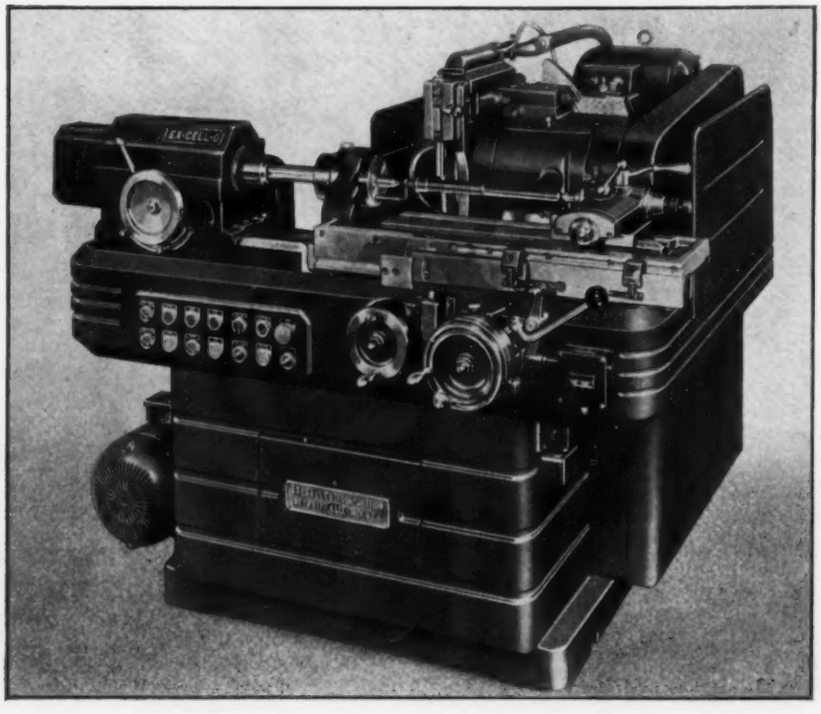
Press action is accomplished by the "Hydro-Power" closed circuit operating system mounted overhead. This system is powered by a 100-hp. electric motor driving a No. R-200 "Hydro-Power" radial pump. Direct connected to this pump are three cylinders, the main cylinder and two auxiliary pullback cylinders. There are no operating valves between pump and cylinders. Ram return is accomplished by reversing the pump instead of controlling the oil flow by operating valves, thus providing fast closing and opening speeds. Ram travel control is either manual or automatic.

Ex-Cell-O Precision Thread Grinder Grinds Threaded Sections 8-in. Long

One of the three precision thread grinders to have been introduced by Ex-Cell-O Corp., 1224 Oakman Blvd., Detroit, Mich., at the Machine Tool Show is the Style 33 external grinder for grinding threaded sections up to 6 in. in diameter, 8 in. long, on work up to 18 in. between centers. An improved taper attachment permits grinding up to 3 in. included taper per foot.

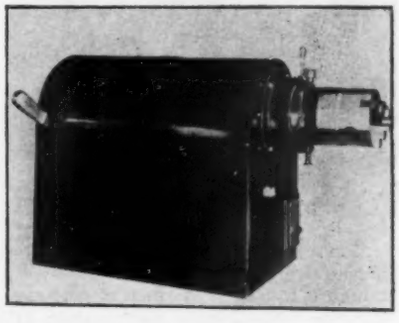
This grinder is self-contained, electrically operated and controlled, and uses 18 in. wheels running in oil coolant. It grinds continuous and multiple right- and left-hand threads with any pitch from 1 to 80 per inch. Most standard threads can be produced directly from solid, hardened blanks on a production basis. Either of two types of automatic wheel dressers may be used with this grinder, both of which are electrically driven and mounted on a slide behind the wheel. With either type dresser, the machine compensates automatically for the amount dressed off the wheel.

The machine has a manual retracting lever which enables the operator to retract the grinding wheel for removing the finished work piece and reloading. At the start of a new grinding cut, the retracting lever can be positioned for a single cut, or a succession of cuts, to finished size without disturbing the finished size setting of the wheel slide. Lead accuracy is assured by the use of interchangeable master lead screw and nut assemblies. A lead pick-up or positioning device permits locating previously roughed threads in correct relation to the grinding wheel.



Infinitely Variable Speed Provided by "Ideal" Lathe

Infinitely variable spindle speeds ranging from 75 to 6,350 r.p.m. are provided in the polishing head of the Type VA1B "Ideal" variable speed lathe developed by the Schauer Machine Co., 2060-68 Reading Road, Cincinnati, Ohio. Range of speed variation is approximately 6.8 to 1 with a single-speed motor and 14 to 1 with a two-speed motor. Speed

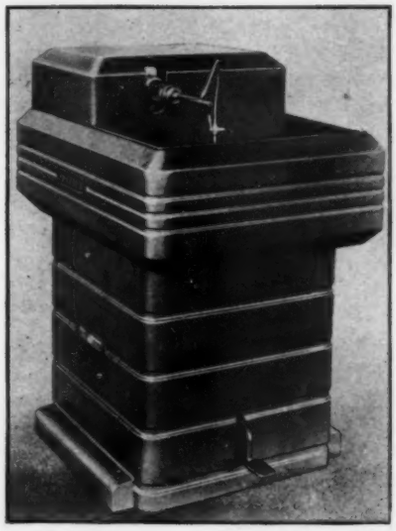


variation is accomplished by a variable-pitch pulley and standard V-belts. Speed is controlled by a conveniently located hand lever, and it is unnecessary to stop the lathe while speed is being changed. Built for bench mounting, the machine has an overall length of 26½ in., width of 11⅛ in., and height of 16$\frac{3}{16}$ in., and occupies a bench space of 11x18 in.

Internal Lapping Machine Finishes Small Holes

An internal lapping machine designed to increase the accuracy and to reduce finishing cost of holes ranging from ¼ to 1 in. in diameter has been developed by the Ex-Cello-O Corp., 1224 Oakman Blvd., Detroit, Mich. This machine is said to be particularly adapted to finishing holes unsuited to other high precision finish machining methods, such as holes interrupted by keyways, slots, cross holes, etc.

Features claimed for this machine include: high rate of output, long lapping stone life, operating convenience, ease of adjustment for size of hole and ready interchangeability



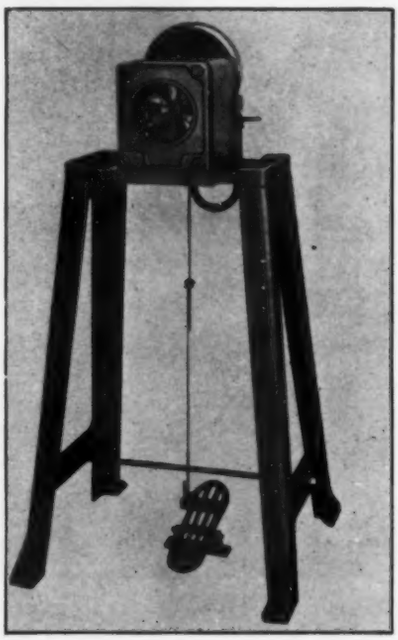
from one hole size to another. A special feature is the design of lapping stones and holders whereby lapping stones can be expanded at any place in the hole.

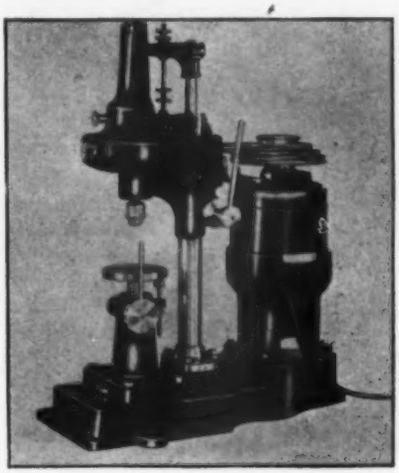
"Multi-Miller" Performs Profiling Operations

Cam-controlled automatic vertical spindle head feed synchronized with cam-controlled table feed enables the Model No. MM-52 "Multi-Miller" developed by the U. S. Tool Co., Ampere, N. J., to perform profiling operations. One operator can attend to as many as six machines, since the operator is required for loading and unloading only. Machine has been designed especially for milling parts of small mechanisms such as typewriters, sewing machines, electrical instruments, cameras and airplane engine accessories. A typical cycle would be: quick approach to cutting positions, cut at one level, cut vertically to second level, cut at second level, raise spindle to clear and quick return to loading position. Any contour within the range of the 2-in. vertical motion and 6-in. table movement can be milled on the machine. Unit is powered with a 1-hp. motor, contains a complete coolant system, and is equipped with an automatic lubrication system. It weighs approximately 1,650 lb.

Tube Piercing Machine Punches Multiple Holes

The Model 1001 multiple hole piercing machine developed by the Automatic Mfg. Co., Inc., Harrison, N. J., will punch any reasonable number of holes in tubes and cans of paper, bakelite, aluminum or similar materials. Size range is from $\frac{3}{8}$ to 2 in. inside diameter and with any wall thickness commonly encountered with this type of material. Holes may be spaced in any position around the tube circumference and along a length of approximately 6 in. Cost of initial tooling up is slight, amounting for the average tube to approximately that required to make a simple drill jig. Additional holes may be added to initial set-ups as required, and holes also may be omitted in set-ups if desired. After initial tooling is completed, change-over from one job to another can usually be accomplished in from 5 min. to $\frac{1}{2}$ hr. Construction is such that it is impossible for the operator to place fingers under the punches. Air connections are provided for removing chips.



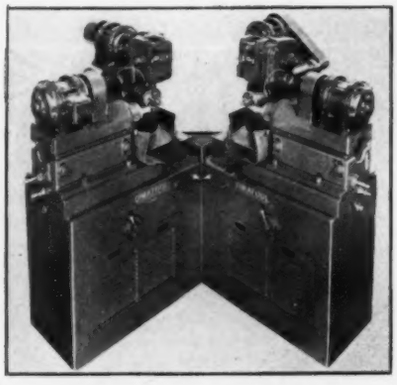


Supersensitive Drill Has Extensive Range

A drilling range of from 0.004 to $\frac{1}{4}$ in. diameters inclusive is provided in the Model R-53 "High Speed" supersensitive drill developed by the High Speed Hammer Co., 319 Norton St., Rochester, N. Y. Standard spindle speeds are 750, 1,500, 3,000 and 6,000 r.p.m. Since drills smaller than the No. 80 require a machine of extreme sensitivity and precision, the supersensitive table is employed when using these drills. In this device, an adjustable spring is tensioned so that the work and table are fed upward to the drill, the spindle being locked in a fixed position. When using drills larger than the No. 60, the table is locked in any desired position and spindle operated in the conventional manner.

No. 103 1/2-C Chamferer Has Two Work Heads

Similar in operation to the No. 105-B gear tooth chamfering machine, the No. 103½-C chamfering machine offered by the Cimatool Co., 1517–1531 E. Third St., Dayton, Ohio, has two work heads and two cutter spindles which, in effect, provide that two work gears can be chamfered simultaneously, or, where more efficient, one part can be machined while the other part is being loaded. The cutter head on this machine, like

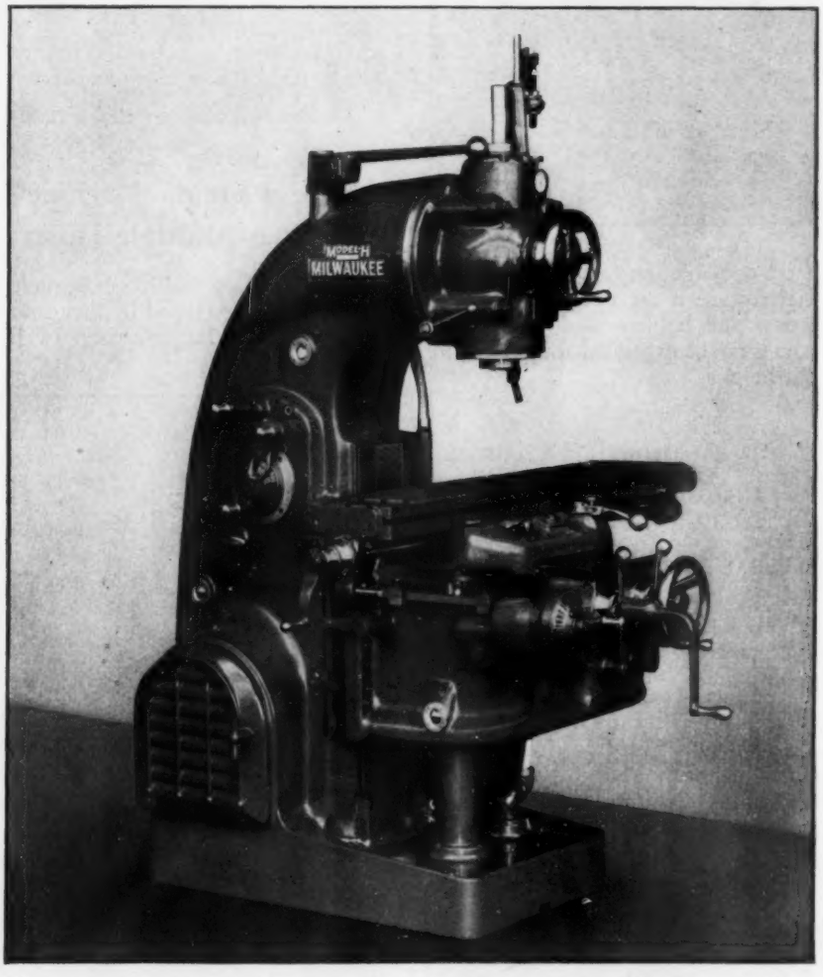


that of the No. 105, accommodates either pencil cutters or hollowmills. In changing over from one job to another, nothing but an adapter is required, except in cases of a change in pitch. This requires a master drive gear of the same pitch as the work gear. The No. 103½-C machine incorporates a few more parts than the No. 105-B, but it is usually more economical for short runs where change-over time is important.

No. 15 Heavy-Duty Drill Can Be Set-Up Quickly

Available both in standard floor and bench models, the No. 15 heavy-duty production drill being exhibited at the Machine Tool Show in Cleveland by Buffalo Forge Co., 448 Broadway, Buffalo, N. Y., can be adjusted quickly for changes in set-up necessary for short run work. Both models have five speeds, obtained by shifting a V-belt on stepped sheaves. Spindle pulley is carried on a long-driving sleeve which runs in two sealed bearings. The inner sleeve has a standard six-spline drive. The table tilts to any angle and has accurately bored holes to locate it accurately in the horizontal position. Spindle has automatic quick return. Capacity is ½ in. in cast iron.

K & T Swivel-Head Vertical Millers Used for Angular Operations

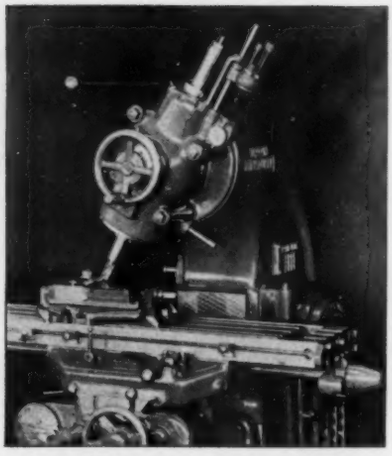


Three types of swivel heads are available for these vertical "Milwaukee" millers. Spindle speed can be as high as 2,400 r.p.m.

Made in three sizes—No. 1 Manufacturing, No. 1H and No. 2HL—the small swivel-head vertical milling machines developed by Kearney & Trecker Corp., Milwaukee, Wis., are designed primarily for increasing production by making it easy to set up for angular milling operations on small precision parts. Three different types of swivel heads, all adjustable through 360 deg. in a vertical plane, are available for both the plain and manufacturing models. These three types are the swivel head vertical with non-adjustable spindle, the swivel head with 3½-in. adjustable spindle, and the fully universal swivel head with 3-in. spindle adjustment.

All three models are equipped with a No. 40 National Standard taper spindle and are driven by a 3-hp. motor. Two speed ranges and five distinct feed ranges are available for all models. The all-geared type speed ranges run from as low as 35 r.p.m. to as high as 2,400 r.p.m. The feed ranges are in five groups—the low group being ¼ to 10 in. per min. and the high group being from ½ to 60 in. per min.

The No. 1H swivel head vertical miller shown has 3½ in. of hand ad-



This swivel-head K. &T. miller can be used for machining parts for fire-arms and typewriters

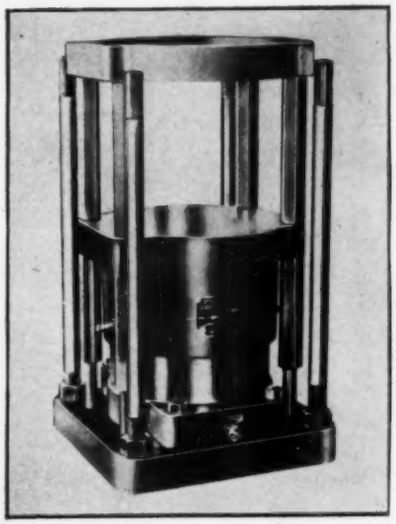
justment to the spindle. The Series H machine features a solid back column, a cross-mounted motor, full automatic lubrication in the column and knee, and other improvements. Controls can be operated from either the front or the rear of the table.

Flexible Shaft Grinder Built for Heavy Work

Heavy grinding, polishing and buffing is claimed to be easily done with the 3-hp. geared-head flexible shaft grinder developed by the Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill. Mounted on two wheels for ease of moving about, the motor operates on 220 or 440 volts, 60-cycle, three-phase power. It is totally inclosed and dust-proof, and is capable of delivering up to 6 hp. on momentary overloads. Flexible shaft and grinding wheel speed is 5,500 r.p.m. Large mounting wheels can be furnished with either steel rims or pneumatic tires.

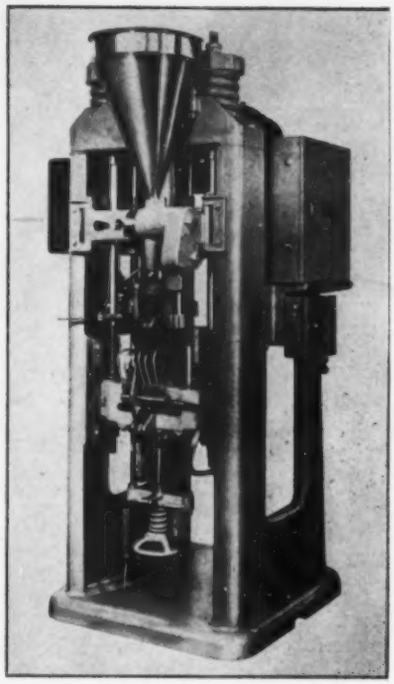
Pneumatic Die Cushion Provides Slug Clearance

The Model CS pneumatic die cushion offered by the Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis, Minn., lends itself to many installations on various inclinable and straight side presses where it is necessary for the slugs, scrap or blanks to pass through the die proper, including the bolster plate and pin pressure pad. This cushion permits the draw ring pressure pins to pass through the bolster plate and come to rest on the top of the pin pressure pad, allowing this pad to bump against the under side of the bolster plate. Pin pressure pads can be provided with openings of practically any size up to the limit size of the cushion for slugs or blank clearance. This design of cushion can also be used to advantage on various compound dies for controlling stripper plate action. These cushions are available in five sizes ranging from 6 to 14 in.



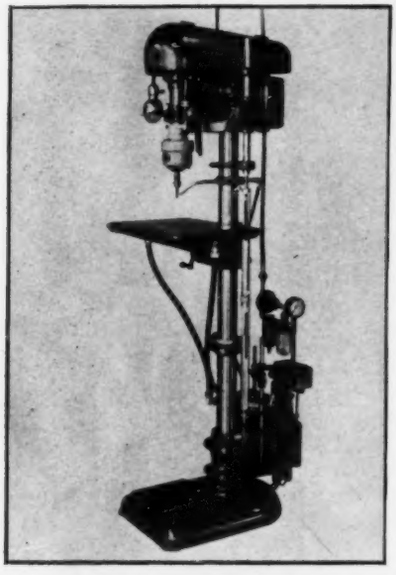
Stokes Molding Machine Has Adjustable Stroke

An adjustable bolster to reduce the length of ram travel and thus increase production rates on shallow work is incorporated in the design of the No. 202 automatic plastic molding machine developed by the F. J. Stokes Machine Co., 5930 Tabor Rd., Philadelphia, Pa. Rated at 15 tons with a 10-in. stroke, this machine will produce parts requiring up to 18 tons pressure and measuring up to 4 in. in height, 6 in. in length and 19 sq. in. in projected area. Unit is self-contained and is electrically heated and powered. It stops and sounds a warning signal if a molding fails to eject or if the material hopper becomes empty. Machine is quickly set up or changed over from one job to another, is efficient on short-run operations as well as on quantity production. It requires no manual operating attention, and handles all free-flowing thermal setting materials. Output from one single-cavity mold is up to 10,000 pieces per week.



"Universal" Tapper Is Air Operated

Compressed air actuates the tapping head in both the drive and reverse directions in the "Universal" tapping machine offered by Procunier Safety Chuck Co., 14–18 S. Clinton St., Chicago, Ill., thereby controlling production and minimizing tap breakage. Precision is achieved through the use of double-acting compensating springs within the adjustable tension housing. These springs assure uniform tapping pressure both in driving and backing out the taps. Should the taps become jammed, the springs com-



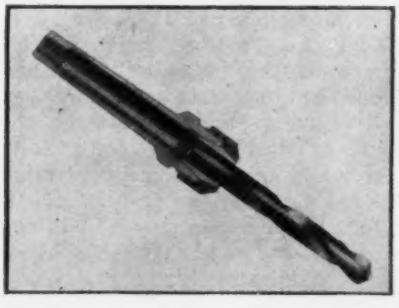
press, allowing the air unit to complete its cycle with no damage to the tap or work.

Rate of feed for both tapping and backing out is controlled by two needle valves. These operate independently of the length of spindle stroke, which is adjustable from $\frac{1}{4}$ to $3\frac{1}{4}$ in. by means of a trip arm. An automatic control valve can be opened for continuous operation or set for foot button control.

The machine has a capacity of from No. 2 tap to $\frac{5}{16}$ in. in steel, $\frac{3}{8}$ in. in cast iron, or $\frac{1}{2}$ in. in brass, using two interchangeable tapping heads. Speeds of 390, 745, 1,280 and 2,050 r.p.m. are available through four-step cone pulleys. Built-in coolant pump is provided. Complete machine includes automatic air line lubricator, air cleaner, and air pressure regulator and gage.

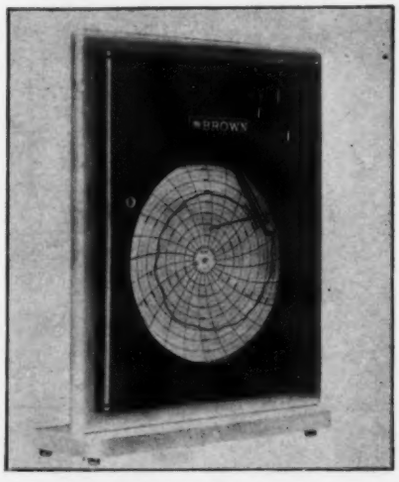
Release Spring Improves Universal Collet Chucks

An automatic release spring has been incorporated in the design of the "Universal" collet chucks manufactured by the Universal Engineering Co., Frankenmuth, Mich. Operation of the device is as follows: as the nut is turned, a spring behind the collet forces the collet forward, allowing it to spring open, thus automatically releasing the grip on the tool. The chuck has threads ground from the solid after hardening, a handy wrench grip, and is available in a range of sizes from $\frac{1}{16}$ in. to $1\frac{1}{2}$ in.



Improved Instruments Have Wide Range

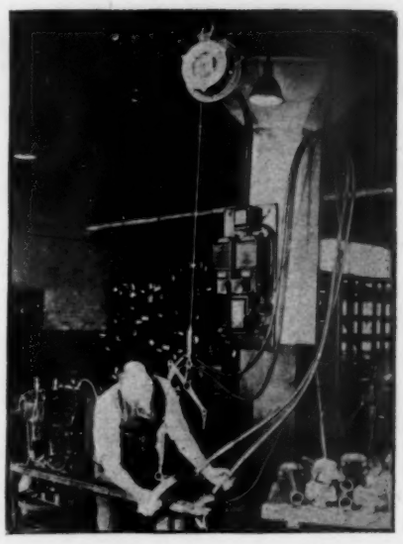
An improved line of temperature and pressure recorders, indicators and controllers placed on the market by the Brown Instrument Co., 4501 Wayne Ave., Philadelphia, Pa., includes thermometers indicating and recording temperatures from —40 F. up to 1,200 F., and indicating or recording



pressure and vacuum gages calibrated up to 2,500 lb. per sq. in. All types are offered in one, two or three pen models. A safety link between actuating element and pen provides an overload safeguard. Charts, when renewed, are automatically in time, as its holding stud is in effect the hour hand of the electric clock.

"Super Safety" Balancer Holds Portable Tools

Outside mounting of the spring in the "Super Safety" tool balancer announced by Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., permits using the largest possible diameter spring in any given balancer capacity, thus lessening friction between coils and insuring smooth balancing. The spring is inclosed in a retainer cover to reduce accident hazard. An automatic safety lock operates immediately in the event of spring breakage. The stop and safety latches are made of drop-forged steel and are cushioned against rubber. The spring can be adjusted for any load within its range. Standard ratings for the fifteen sizes available range from 10 to 200 lb. maximum balancing capacity. Length of travel of cable is 6 or 7 ft.



"Vortexeddy" Spray Tank Rinses Racked Parts

Storts Welding Co., 122 Stone St., Meriden, Conn., has introduced the "Vortexeddy" spray tank especially designed for rinsing racked parts in electroplating departments. Rinsing operation is performed by alternate vortices of spray streams circulating clockwise and counter-clockwise and interrupted by straight-line spray

"MODERN" MEANS MORE THAN MERELY "NEW" IN THE DESIGN OF MILWAUKEE MILLING MACHINES

CHANGES and developments in milling machine design must be more than merely "new" to measure up to the K&T concept of what is "modern" . . . If the "new" offers definite improvements in performance — proven by exacting tests on actual work — K&T engineers pass on these benefits to milling machine users . . . Only by such careful analysis and practical tests can basic progress in milling machine design be made . . . Concentrating on the building of milling machines exclusively—for more than 41 years—has won for the Kearney & Trecker Corp. world-wide recognition for the most advanced milling machine design and construction.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U. S. A.

PROFIT MORE WITH K&T PRODUCTS

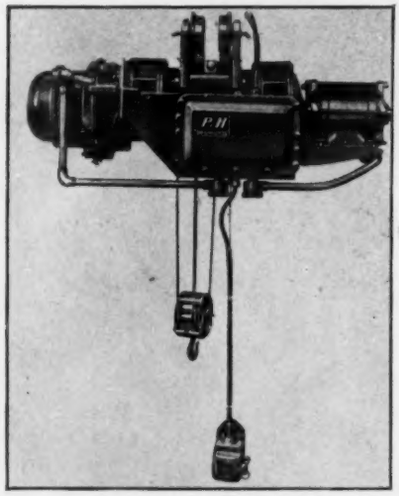
K&T

Milwaukee **MILLING MACHINES**

streams. Provision is made for turning the work so that every portion of the surface is subjected to the impact of the high-velocity jets. Water flows only while work is in rinsing position. Better cleaning is also said to be accomplished, because of the high velocity spray and the use of only fresh uncontaminated water. Standard sizes range from 24 x 24 x 36 to 36 x 24 x 36 in. Both pedal and hand lever types are available.

Explosion-Proof Equipment Available for P&H Hoists

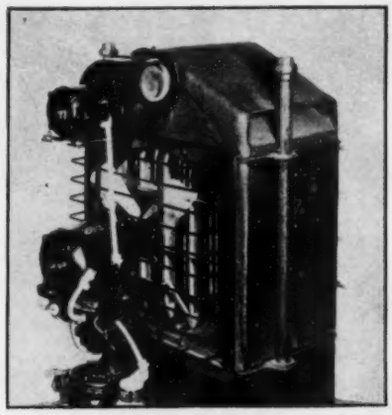
The Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis., now is offering explosion-proof electrical equipment for P&H electric hoists. Hoists so equipped have explosion-proof motors rated at 30 min. 55 deg. and explosion-proof reversing starters, together with geared upper and lower



limit switches and push-button stations. All of this equipment bears the underwriter's approval for Class I, Group "D" hazardous location. The wiring is in rigid conduit with explosion-proof fittings, and the electric brake is inclosed in a heavy cast iron cover which is bolted to the gear case cover. A flexible cable connection is used to further reduce the possibility of sparking.

Gas-Fired Unit Heaters Have Automatic Flues

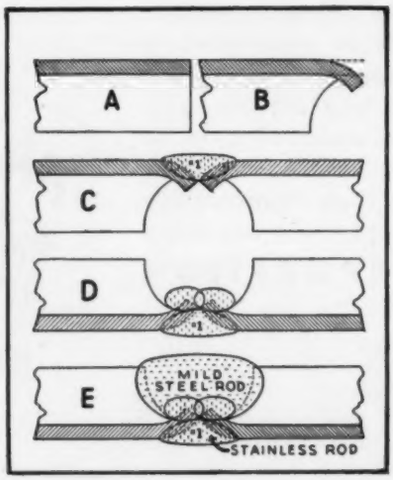
The Automatic Gas-Steam Radiator Co., 403 Brushton Ave., Pittsburgh, Pa., has announced a series of five gas-fired unit heaters, ranging in capacities from 85,000 to 200,000



B.t.u. per hr. These heaters employ natural or manufactured gas for fuel and are applicable for many types of buildings. The automatic flue consists of a motor and blower connected in such a way that when the heater starts, the flue automatically carries products of combustion through the pipe and wall to the outside. Assembly includes a safety pilot which turns off the gas as the pilot goes out or burns too low to insure ignition. Air is passed around the heating tubes by means of a motor-driven fan located at the back of the unit.

New Process Welds Stainless Clad Steel

The Composite Steel Div. of the Jessop Steel Co., 595 Green St., Washington, Pa., has developed a method of welding stainless clad steel that minimizes reduction of corrosion resistance in the weld zone. Referring to the accompanying sketch, *A* shows the plate as supplied, the shaded portion representing the cladding. Plate is then scarfed and the cladding bent down as in *B*. The primary weld (Bead No. 1—sketch *C*) is made



with a $\frac{1}{8}$-in. diameter stainless steel coated rod at the juncture of the two claddings. The two plates are then turned over and secondary welds made on the underside of the exposed cladding, as indicated at *D*, using a $\frac{3}{16}$-in. diameter stainless steel coated rod. The final weld, joining the mild steel backing, may be made with a $\frac{1}{4}$-in. diameter mild steel coated rod, resulting in the completed weld shown in *E*. Bead No. 1 may then be ground flat with the cladding. In all cases where stainless rods are used, the rod should be richer in alloy than the cladding. Lowest possible amperage and fastest possible welding time are recommended.

Type MO "Multi-Breaker" Handles Small Loads

Cutler-Hammer, Inc., Milwaukee, Wis., has announced the Type MO "Multi-breaker" to provide overload protection for applications such as

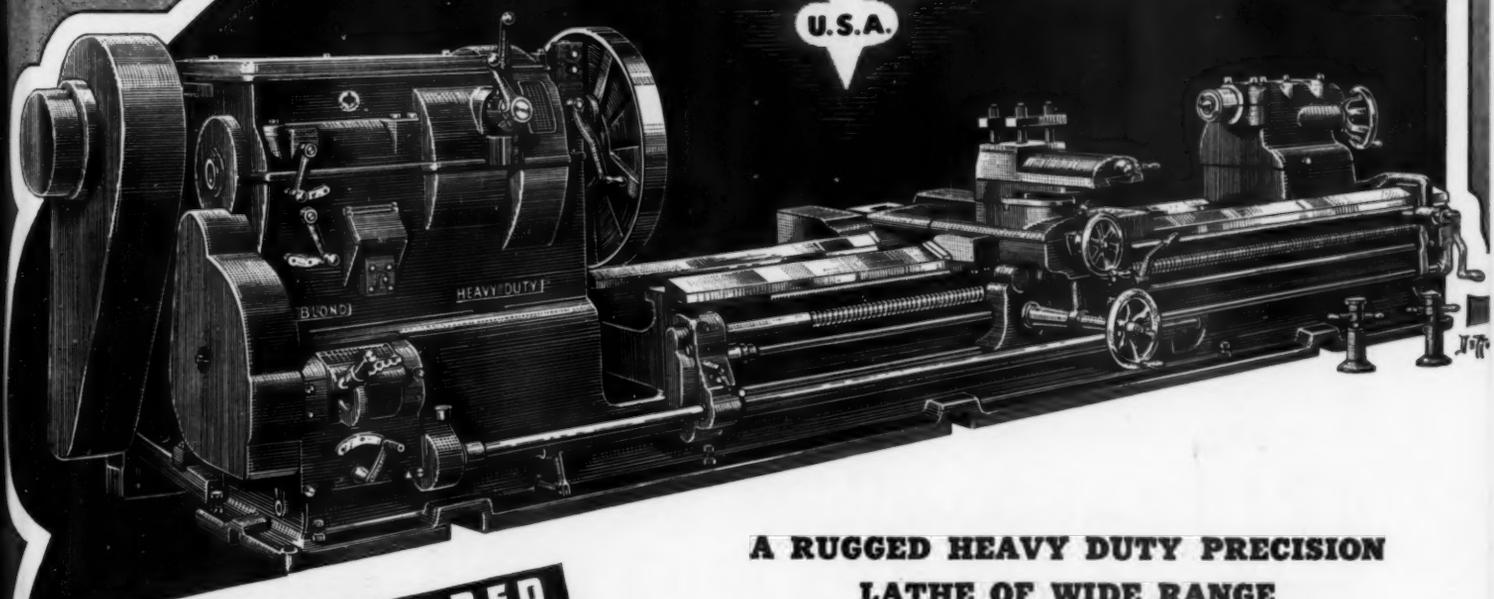
lighting circuits, oil burners, air compressors, electric unit heaters, small tools, grinders, drill presses and similar equipment. It can be installed wherever fused type switches are employed and is available in ratings ranging from 15 to 25 amp.

"Kennametal" Tool Bits Available in Two Forms

McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa., has made available two additional forms of standard "Kennametal" single-point turning, facing and boring tools for machining steel up to 550 Brinnell in hardness. Design of these tools is said to overcome the problem of convenient chip dis-

THE HEAVY DUTY SLIDING BED GAP *Lathe*

LeBLOND
CINCINNATI, OHIO
U.S.A.



A RUGGED HEAVY DUTY PRECISION LATHE OF WIDE RANGE VERSATILITY AND REAL ECONOMY

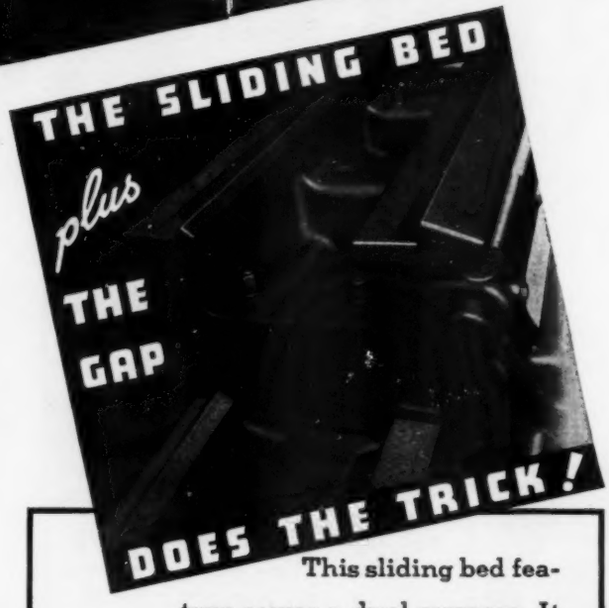
The LeBlond Sliding Bed Gap Lathe, because of its extreme flexibility, is ideal for the plant where the work is irregular in size or shape, with projecting parts, requiring varying center distances and greater clearance.

This one flexible lathe embodies the work capacity of several individual lathes . . . eliminates the need for a wide range of turning equipment.

This remarkable lathe is built in three sizes: 19-38 inch, 25-50 inch, 30-60 inch. On the 19-38 inch, the upper bed slides on the lower for a minimum of 3½ feet; on the 25-50 inch, 5 feet; and on the 30-60 inch, 6 feet.

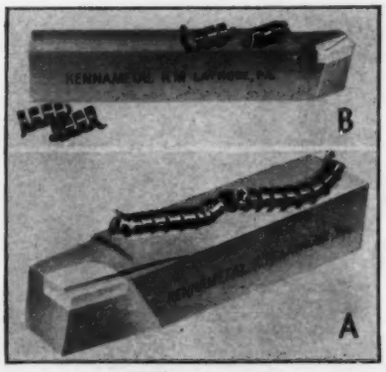
If your work demands flexibility and versatility in your lathes . . . if economy is necessary in original cost as well as in operating cost, the LeBlond Sliding Bed Gap Lathe is the perfect answer.

For additional details write today for Bulletin SBG-537. Address Dept. H-27, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.



This sliding bed feature serves a dual purpose. It widens the gap to provide essential clearance for irregular or projecting parts, and increases the length which may be taken between centers.

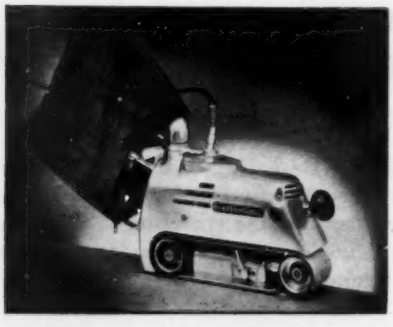
LOWER YOUR COSTS WITH LeBLONDS



posal in cutting steel at high speeds. Sketch *A* shows the parallel chip breaker form, designated as a chip curler, on a standard Style No. 12 right-hand turning tool. Sketch *B* shows the chip breaker ground at an angle, usually 20 to 40 deg. from the side cutting edge, which breaks the chips by deflecting them against the unturned shoulder of the work.

Improved Sander Has Higher Belt Speed

Incorporating several improvements to promote superior work, the Model BB-10 "Take-About" sander-grinder developed by the Porter-Cable Machine Co., Syracuse, N. Y., is pro-



vided with more power and operates at a higher belt speed. A double fan makes the dust collecting system more effective, and improved ventilation makes the unit operate cooler. Belt changing has been made easier by a new lever control, with belt tension automatically maintained. Machine is balanced four ways, making it easier to handle.

Face Shield Combines Three Types in One

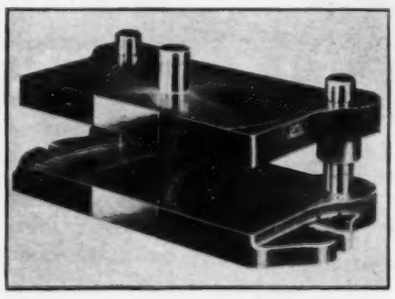
Three types of face shield are combined in one in a new model made by the Boyer Campbell Co., 6540 Antoine St., Detroit, Mich. This feature has been made practicable by interchangeability of parts with the screen, fiber, or "Plastacele" guard quickly buttoned on at the option of the wearer. When fitted with the "Plastacele" window, furnished in clear, green and amber shades, the device is suitable for welding, buffing, polishing, wire brushing, die casting and similar operations. Fitted with the wire screen window, it is recommended for babbitting and other operations requiring heat protection.

Fiber front and glass holder give the wearer protection for acetylene welding and burning. Absorbent leather sweat bands, backed by wool felt, keep perspiration out of the eyes.

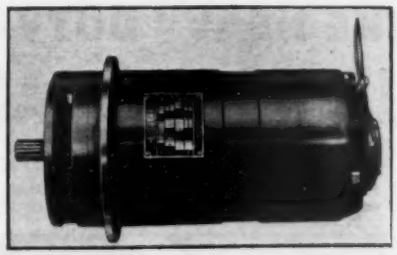
Danly Offers New Line Of Precision Die Sets

Danly Machine Specialties, Inc., 2130 S. 52nd Ave., Chicago, Ill., has announced an enlarged line of Danly precision die sets. Regular, reverse and narrow die sets ranging from 3 x 3 in. to 25 x 14 in. in many thickness combinations of die-holder and punch-holder are available. Included also is a new "square" series of back-post sets for mounting square and round dies, also available in a complete range of sizes from 3 x 3 in. to 14 x 14 in.

Precision guide posts are hardened, ground and lapped to tolerances of plus or minus 0.0001 in. Precision



bushings, of standard shoulder and extra-long types, are ground and honed to the same limits. Any die-holder is interchangeable with any punch-holder of the same center distance, making available a wide variety of thickness combinations.

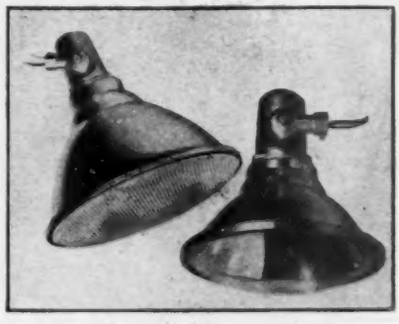


Torque Motors Designed For Built-In Applications

Designed to provide direct power to inaccessible or intermittent operating motions on machine tools and other machinery, the "Welco" line of torque motors offered by the B.A. Wesche Electric Co., Cincinnati, Ohio, has been extended to include frames for built-in construction as well as those for foot and flange mountings. Use of these motors is claimed to simplify mechanical design, provide lower cost and enhance appearance of the machine. An added feature is that this motor can be stalled for long periods without damage. Motors usually are designed for individual installation, thus providing the proper motor for the job.

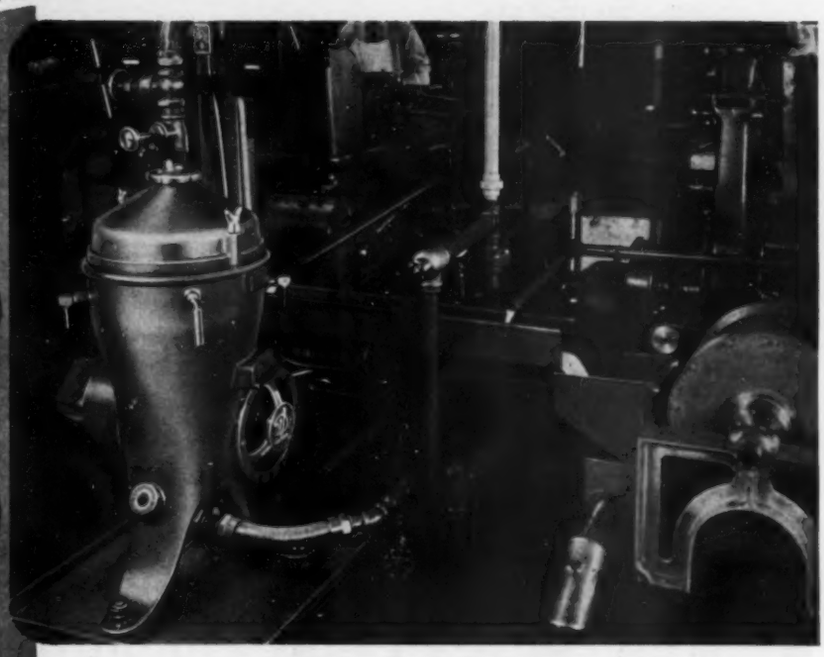
Industrial Units Give Concentrated Lighting

Two industrial concentrator lighting units for lighting horizontal and vertical surfaces from an oblique angle have been announced by West-

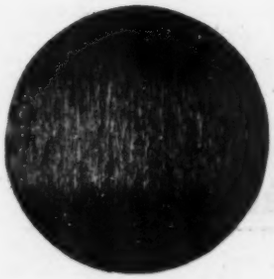


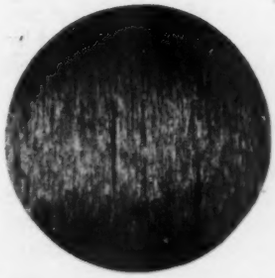
inghouse Electric & Mfg. Co., East Pittsburgh, Pa. These supplemental lighting units are recommended for fine assembly work, inspection, spray booths, precision machine work and for paint shops. The complete unit consists of an aluminum reflector, a porcelain socket assembly, cast-aluminum socket housing and aluminum swivel-mounting bracket for ½-in. conduit mounting. It employs a one-piece reflector treated by the Alzak process. Heat-resisting glass lenses, either plain or heavily stippled, are

IMPROVE FINISH-REDUCE COSTS



by Keeping GRINDING COOLANT CLEAN WITH DE LAVAL EQUIPMENT





The above illustrations, magnified 12 diameters, show the difference between the use of clean and dirty coolant under otherwise identical conditions of wheel and work. Note complete absence of scratches in the top illustration which shows the result of grinding with clean, De Laval-clarified coolant. Note the two large scratches, at center and at right, of the lower illustration which shows the result of grinding with dirty coolant.

The illustration above shows how a leading manufacturer is meeting the requirement of "clean grinding coolant for precision grinding": a De Laval "Air-Tight" Coolant Clarifier which employs centrifugal force to continuously remove from the coolant even the tiniest particles of metal and abrasive.

Continuous removal of these impurities avoids scratches on the work, avoids damage to sub-surface structure and makes it possible to grind within closer limits. Moreover, it enables the same coolant to be used indefinitely and so makes it economical to employ the kind of coolant best adapted to the work—regardless of cost.

In most grinding operations numerous other economies are effected by the De Laval Coolant Clarification System. Softer wheels can be used; the life of wheels is increased; production is speeded up, and there are fewer rejections.

Write for full information regarding these and other economies effected by De Laval centrifugal machines in modern metal working plants.

DE LAVAL COOLANT CLARIFIERS

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

supplied. The 10-in. unit, shown at the right, uses 200-watt clear or inside frosted bulbs, and the larger 14-in. concentrator shown at the left uses 300- or 500-watt clear lamps.

Elastic Stop Nuts Now Made to Order

The Elastic Stop Nut Corp., 1015 Newark Ave., Elizabeth, N. J., has announced that, in addition to its standard line of self-locking nuts, these stop nuts now can be furnished on order in any metal and in any combination of style, size and thread system. These nuts incorporate a resilient non-metallic collar which takes up all thread play, thus establishing a constant thread contact which holds the nut in position on the bolt, regardless of vibration or wear of surrounding parts.

K&E Tracing Paper Made with Albanite

Combining the transparency of oil-treated sheets with the permanence of natural 100 per cent rag paper, "Albanene" tracing paper developed by Keuffel & Esser Co., 127 Fulton St., Hoboken, N. J., is made of 100 per cent long fiber clean white rags treated with a crystal-clear synthetic solid called Albanite. Because this transparentizing agent is free from oil and wax, and both chemically and physically inert, it is claimed that Albanene will not oxidize, turn yellow, become brittle, or lose transparency with age.

It is claimed that the use of this transparentizing agent permits a fine toothed, smooth drawing surface that takes strong pencil lines with a minimum wear on the point. On Albanene all lines are held by the fine hard tooth and do not become embedded in the paper structure, making Albanene easy to erase or correct.

"High-Speed" Enamels Withstand Abuse

Claimed to be especially suitable for use on metal products subjected to severe service, the "Codur" synthetic enamels developed by Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J., are said to reduce considerably the time needed for finishing. They are furnished in all plain colors and also in colors with metallic lusters. Baking for 15 min. at 325 F. is claimed to be sufficient.

PERFECTED!

Four years of development have produced the perfect *Super Service*

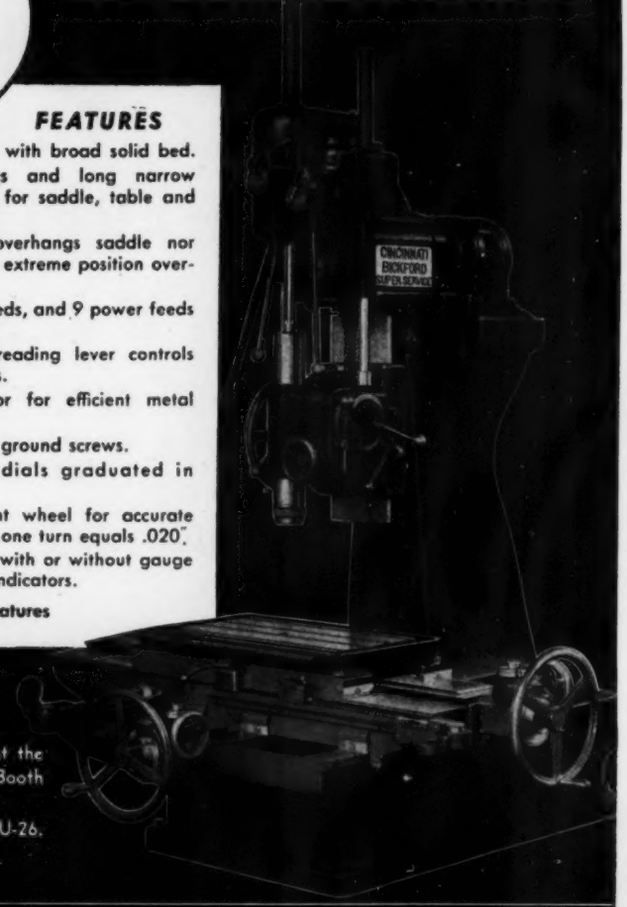
JIG BORING MACHINE

For Tool Room and for Small Lot Production

FEATURES

1. Massive frame with broad solid bed.
2. Wide bearings and long narrow gibbed guides for saddle, table and sliding head.
3. Table never overhangs saddle nor does saddle at extreme position overhang base.
4. 12 spindle speeds, and 9 power feeds down and up.
5. Single direct reading lever controls speeds or feeds.
6. 3 H. P. motor for efficient metal removal.
7. Hardened and ground screws.
8. 8" diameter dials graduated in thousandths.
9. Fine adjustment wheel for accurate table setting—one turn equals .020".
10. High precision with or without gauge rods and dial indicators.

Many Other Features



See this machine at the Cleveland Show, Booth No. 5610.

Write for Bulletin U-26.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

TRADE PUBLICATIONS

BELTING "Belting Biographies," a 36-page illustrated booklet describing an extensive line of transmission and conveyor belts, has been published by the Mechanical Goods Div., United States Rubber Co., 1790 Broadway, New York, N. Y.

CENTRIFUGALS A 20-page illustrated booklet published by the Sharples Corp., 2336 Westmoreland St., Philadelphia, Pa., lists various applications of centrifugals and describes features of various models.

DIE CASTINGS A considerable amount of detailed data concerning the working of die castings has been assembled in a 24-page illustrated booklet, "Practice in Machining Zinc Alloy Die Castings," published by the New Jersey Zinc Co., 160 Front St., New York, N. Y.

GRINDING A series of illustrated catalogs published by the Bryant Chucking Grinder Co., Springfield, Vt., provides detailed information

concerning precision grinding equipment and its application. Available are a 24-page bulletin on the Series 16 grinders, a 28-page bulletin on the Series 5 grinders, a 40-page catalog on single-slide internal and hole and face grinders, and a 100-page catalog illustrating the use of various types of grinders in producing aircraft engine parts.

INSTRUMENTS Bulletin No. 536, issued by the Bristol Co., Waterbury, Conn., gives information regarding a line of pH recording and controlling instruments.

LATHE Bulletin No. 43, issued by the Technical Service Dept., South Bend Lathe Works, 229 East Madison St., South Bend, Ind., describes and illustrates features of the models A, B and C "Workshop" lathes.

MILLING ATTACHMENT The "All Angle" full universal milling attachment made by Frey-Mershon, Inc., Glendale, Calif., is described in an 8-page illustrated pamphlet.

NICKEL ALLOYS A six-page bulletin containing basic information on the mechanical, corrosion-resistant and other properties of rolled nickel, Monel, and other high nickel alloys has been published by the International Nickel Co., Inc., 67 Wall St., New York, N. Y. Considerable fabrication data is included in this bulletin.

WRENCH The "Favorite" reversible ratchet wrench is described in a leaflet issued by Greene, Tweed & Co., 101 Park Ave., New York, N. Y.

Using Ferrous Metals To Reduce Weight

By E. J. W. RAGSDALE
E. G. Budd Manufacturing Company

Nicolai Tesla once said, "The laws of nature are few and simple. They are complicated only by our inability to think simply." This is particularly true of structures. The simpler the structure, the more effective it is apt to be. Actually, all we have to consider is a happy combination of tension rods and compression columns.

Most materials behave well in tension and will develop their full strength under this form of stressing. Compression is another matter. It concerns design. The natural tendency of any structural member under a compressive load is to evade rather than to carry that load. It is the business of the designer to see that the member is held to its work. For instance, a sheet of paper on edge will not support its own weight and yet, if rolled into a tube, it will support a very substantial compression. The sheet of paper by itself lacks what we call "stability." This is plate stability. When rolled into a tube it gains in plate stability. However, when that tube gets too small in diameter for its length it again will try to evade the load through lack of "column stability."

Stability of columns has long been known and established. The stability of thin plates has been of more recent concern. Light-weight construction uses thinner materials and stresses them higher. How important this is in connection with designing for any particular material will be evident from the following. A wooden panel is 90 times more stable than an aluminum panel plate of like size and weight and 250 times more stable than a similar panel of steel. That is the reason why light-weight construction has had to be progressively developed, first through wood, then with the light alloys and

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finally with steel. A strange commentary is that no matter whether you build with wood, with the aluminum alloys, or with high tensile steel, the relation between weight and strength will remain theoretically about the same.

The various considerations which lead to the choice of any one of these three such dissimilar materials do not come within the scope of this paper. Suffice it to say that while their weights and strengths compensate so as to make them apparently equivalent, their great difference lies in their respective bulkiness and hence their respective stability. A sufficient story is to be found in how steel, with a 250 to 1 disadvantage against the stability of wood and a 3 to 1 disadvantage against aluminum, can yet be fabricated so as to have an actual structural advantage over either wood or the aluminum alloys.

Again the answer is simple—corrugate. Any paper packing case will illustrate the way. Paper, as previously mentioned, has in itself no inherent stability. For practical reasons, such as the attachment of corrugated surfaces to other flat plates, it is best to use flatted corrugations instead of the old familiar rounded form. How wide these flats dare be depends upon the metal thickness; in fact, there is a definite relation between the width of the flat, the thickness of the metal and the amount of compression which can be imposed along the direction of folding. This relation between flat width and thickness has been called "flat pitch." The thickness divided into width gives the flat pitch number for any long unsupported flat face of a corrugation or closed column.

Using this number as a base we have determined experimentally a flat pitch curve from which we can fix for any given flat pitch number the compressive stress which the corresponding flat face will take without buckling. This stress is given as a percentage of the ultimate tensile strength of the steel. This curve applies only to very short columns. It is in effect a gage of plate stability. For column stability the usual formulas obtain. These, however, would be misleading if the faces of the cross-section happen to have such a high flat pitch number that they buckle long before the column is stressed to its calculated capacity.

Still another form of stability might be called "joint stability." This refers to the connections of the various members of a structure. They cannot be eccentric, nor can they be flimsy, as they would be if the attaching gusset plates themselves were lacking in stability. Speaking of gussets brings up the question of plates and possible application as structural elements. It becomes a basic consideration in designing for lightweight construction.

When I went to school, the classic form of structure was "pin-jointed." It was pin-jointed largely because that was the only way in which we knew how to figure it. If the joints happen to be bound by gussets, or otherwise restrained, the structure was said to be "redundant," and that was bad. Even the professor couldn't figure it. Now these aircraft trained youngsters simply revel in redundancies and incidentally produce structures which not only are far more efficient, but which test out just about as calculated. This seems the more remarkable when we consider, for instance, that the deflection calculations for a side truss of a railroad car involve 47 simultaneous equations and that the answer not only is found, but will prove to be absolutely correct.

These modern methods of calculation have little or no relation to the diagrams that we used to draw in graphical statistics. Instead, the truss

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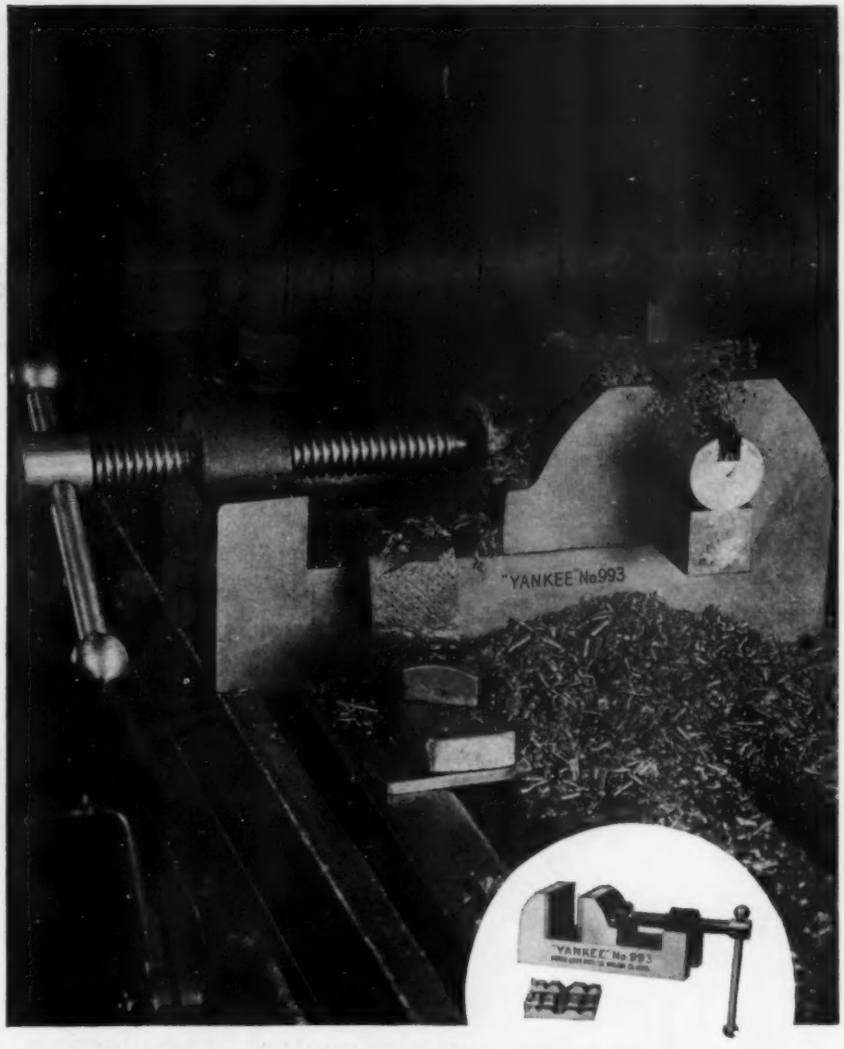
is scientifically analyzed for behavior, panel after panel. In principle, modern methods of calculations are simple. They do not, however, avail anyone if instability creeps in. Stability is, in fact, the keynote of all light-weight construction. To structural stability we might also add corrosive stability, for as metal surfaces become thinner and, since closed sections cannot be painted, a corrosion resistance becomes almost imperative.

Having once arrived at a philosophy of design and an appreciation of the metals available, it remains to interpret these into processes of manufacture. Here, the first and most important step is the establishing of the elements from which a completed structure can be assembled readily. These elements serve in principal the same purpose as the I-beams, channels and angles of conventional construction. They are quite different, however, for they must be capable of far greater stressing.

A further improvement over the conventional structural shape is that all of the metal must be more effectively used. Ineffective metal must be reduced or cut out. Obviously then, structural elements must be such as can be fabricated readily. The elements are those required for the build-up. They consist of formed strips, formed to be stable under high-stressing and formed for effective attachment to other elements. Usually very flexible in themselves, they become rigid when assembled. It might be well to mention that since light-weight construction involves more fabrication than does a conventional structure, that fabrication must be made as simple and as cheap as possible.

The elements of construction can be reduced to a relatively small number of individual sections, each capable of being used alone or combined with others into a stronger section. For instance, in the building of stainless steel railway cars the number of elemental sections used totals about 33. The heaviest strip used in the stainless steel car is ¼-in. thick, while the lightest is the corrugated flooring which is 0.020 in. in thickness. Most of the truss work is built up of elements having a thickness of 0.05 in. The various combinations and uses to which a few elements can be put depends largely upon the ingenuity of the designer.

Briefed from a paper entitled "Engineering Problems Involved in the Use of Ferrous Metals to Reduce Weight" presented before the World Automotive Engineering Congress of the Society of Automotive Engineers at New York City, May 25, 1939.



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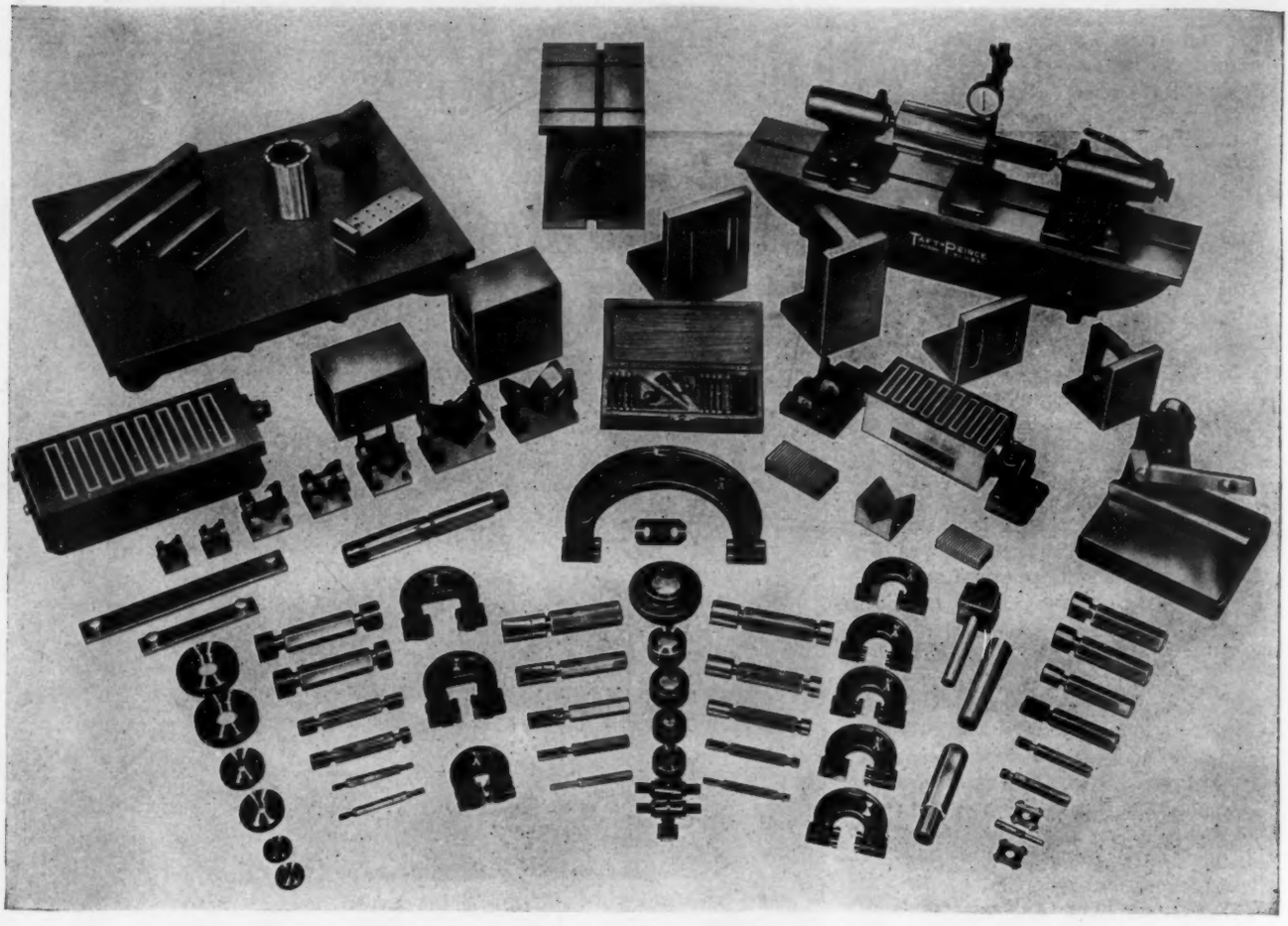

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